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VOLUME XV NOVEMBER 29, 1926 NUMBER 20

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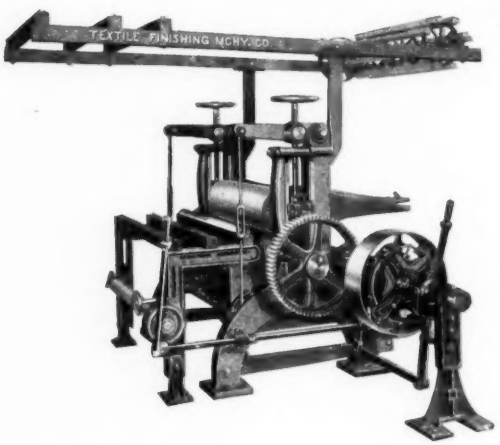

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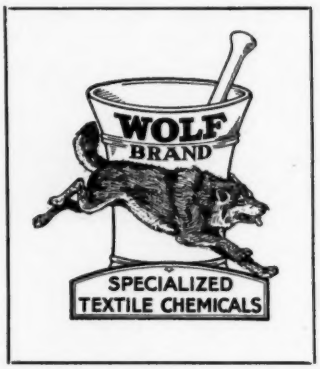

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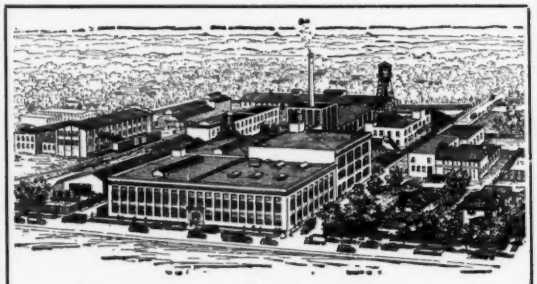

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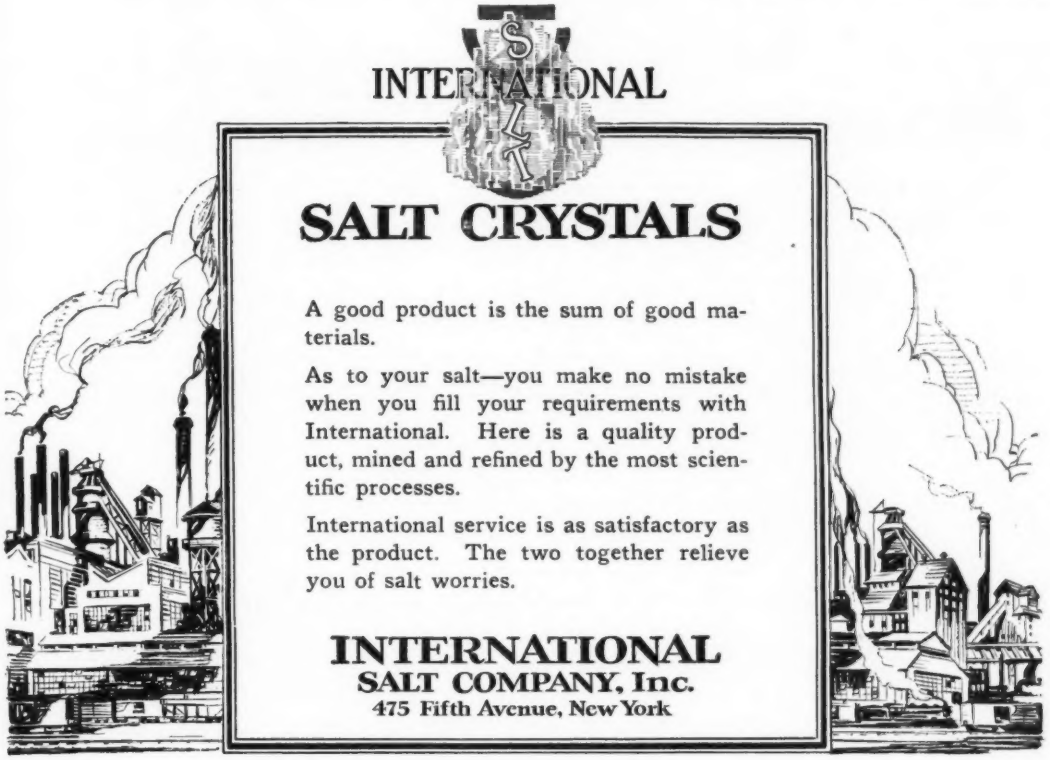

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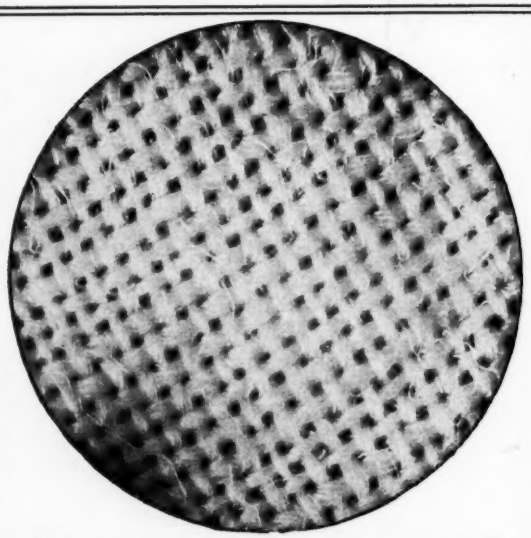

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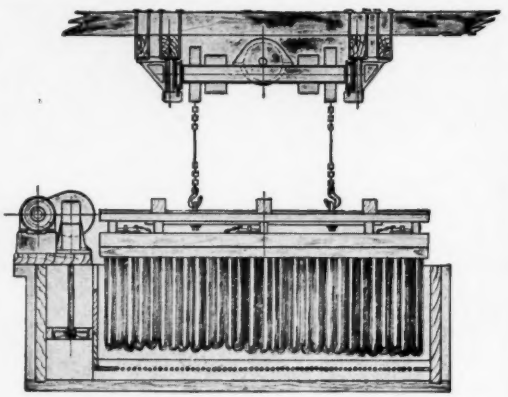

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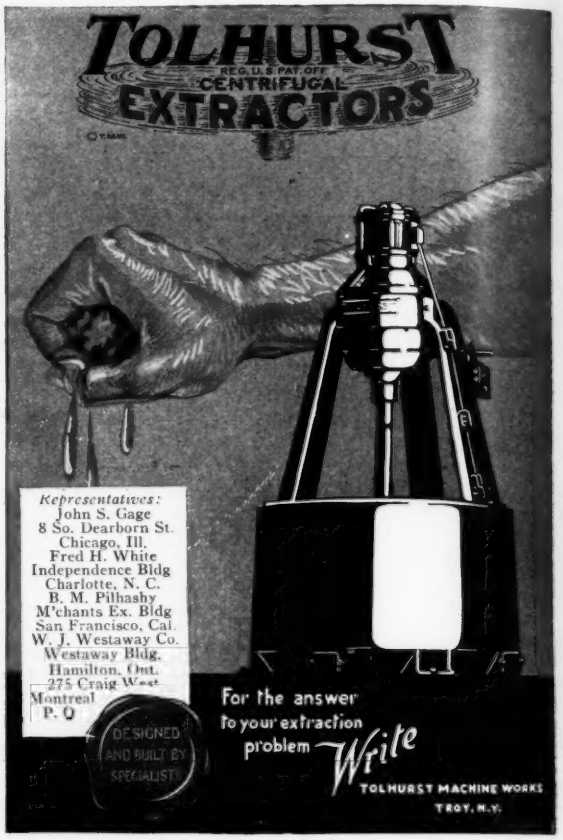

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VOLUME XV NEW YORK, NOVEMBER 29, 1926 No. 20

The General Action of Acids on Wool

Part II

A Review of the Literature Upon the Action of the Acids in General on Wool in Particular—The Adsorption Theory of Combination and the Change in This Theory Due to the Hydrogen Ion Concentration Factor—Removal of Acids from Wool by Rinsing

By CHAS. E. MULLIN, M.Sc., F.A.I.C.

Consulting Chemist and Author of "Dyeing Acetate Silk"

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LLOYD, *J. Soc. Dyers and Colourists 28,* 337-40 (1912), from a study of the tendering action of Glauber salt in the presence of organic acids in the dye bath upon the cotton warps of wool unions, which is very considerable under some conditions, says that "It appears, therefore, that some mineral acid was produced by the wool acting as a catalytic agent. Wool combines very readily with organic acids with formation of an additive compound, which compound most probably reacts with the sodium sulphite of the bath with formation of sulphuric acid and sodium formate (in case formic acid is the organic acid used). This may be represented by the equation:

$$2\ \text{Wool.H.COOH} + \text{Na}_2\text{SO}_4 = \text{Wool}_2\text{.H}_2\text{SO}_4 + \text{TH.COONa},$$

the sulphuric acid being prevented from complete reaction with the sodium formate through being combined with the wool. In this manner one may easily understand the tendering action (on cotton) in a dye bath containing organic acid and mineral salts." He proved that the tendering action was due to free sulphuric acid in the dye bath when Glauber salt was used in the presence of either formic, acetic, lactic, glycollic, oxalic, succinic, tartaric, citric, benzoic, or gallic acid. With tannic acid the proof was less positive. It was also found that the other animal fibers, alpaca, mohair, camel-hair, fur and silk, as well as leather, produce the above action, in the same manner as wool. (Also see a later paper on the action of salts on wool.)

Retention of Acids by Wool

Lloyd, *loc. cit.,* investigated the absorption of acid and its removal from wool by thorough rinsing. A 5-gram sample of the fiber was treated with 100 c.c. of solution containing from 2 to 7.5 per cent of various acids, on the weight of the fiber. The flasks containing the acid and samples were heated on the water bath for an hour, allowed to cool, the liquor decanted off, and the material washed three times in cold distilled water, decanting off the solution as completely as possible before adding a second portion of water. The acid in this solution was then estimated by titration. The difference between this amount and that added being considered as the amount absorbed by the fiber. He then extracted the acid treated samples with three separate portions of 100 c.c. of water on a boiling water bath for a half hour each. On mixing the three extracts and titrating, he found that the amount of acid extracted gradually decreases as the amount of combined acid diminishes. Table XXVI gives his results on merino wool with sulphuric acid, Table XXVII with acetic acid, and Table XXVIII with formic acid.

TABLE XXVI

Absorption and Retention of Sulphuric Acid by Merino Wool

Acid Used (On wt. of wool)	Acid Absorbed	Extractions 1st Three	2nd Three	3rd Three	4th Three
2.0%	1.89%	0.17	0.12	0.087	0.087
2.5	2.31	0.31	0.20	0.152	0.144
3.0	2.68	0.45	0.27	0.184	0.181
3.5	2.81	0.65	0.35	0.231	0.202
4.0	2.96	0.85	0.37	0.273	0.217
4.5	3.01	0.95	0.39	0.260	0.217
5.0	3.20	0.99	0.40	0.267	0.224
5.5	3.71	1.14	0.42	0.267	0.225
6.0	3.93	1.16	0.40	0.267	0.232
6.5	4.62	1.30	0.46	0.280	0.232
7.0	4.93	1.37	0.46	0.295	0.224
7.5	5.24	1.54	0.48	0.308	0.238

TABLE XXVII

Absorption and Retention of Acetic Acid by Merino Wool

Acid Used (On wt. of wool)	Acid Absorbed	Extractions 1st Three	2nd Three	3rd Three
5.0%	2.19%	0.89	0.018	0.008
5.5	2.23	0.96	0.029	0.009
6.0	2.80	1.46	0.028	0.009
6.5	3.45	1.54	0.035	0.010
7.0	3.94	1.91	0.035	0.010
7.5	4.00	2.36	0.098	0.031

TABLE XXVIII

Absorption and Retention of Formic Acid by Merino Wool

Acid Used (On wt. of wool)	Acid Absorbed	Extractions 1st Three	2nd Three	3rd Three
5.0%	1.93%	0.78	0.058	0.009
5.5	1.99	0.74	0.073	0.009
6.0	2.21	1.12	0.088	0.011
6.5	2.42	1.34	0.093	0.015
7.0	2.68	1.42	0.092	0.016
7.5	2.73	1.57	0.095	0.018

Table XXIX gives Lloyd's results on a union fabric containing 73 per cent of mohair and 27 per cent of cotton. Samples of this cloth containing 5 grams of mohair were treated with solutions containing 2 grams of pure sodium sulphate and various amounts of acetic acid, under the same conditions as those given in the preceding paragraphs for the pure fibers. A comparison of the amounts of acid extracted from this union with these obtained with acetic acid on merino, shows that there is no sudden fall in the percentage of extractable acid by successive extractions, but that the results are somewhat similar to those obtained with sulphuric acid. He found the different fibers to give, in all cases, very similar figures to those given in this table (XXIX), under the same conditions.

TABLE XXIX

Absorption and Retention of Acid by Mohair from a Bath Containing Acetic Acid and Sodium Sulphate

Acetic Acid Added	Acid Absorbed (Calc. as Acetic)	Acid Extracted (As Acetic)	Extractions 2nd	3rd
5.0%	3.41%	1.02%	0.41	0.28
5.5	3.62	1.11	0.43	0.29
6.0	3.84	1.31	0.45	0.29
6.5	3.99	1.23	0.48	0.31
7.0	4.26	1.41	0.49	0.32
7.5	4.54	1.57	0.49	0.33

Lloyd found that hydrochloric and nitric acids are freed from their respective sodium salts by the action of formic and other organic acids, and that these free mineral acids react and combine with wool in the same manner as the sulphuric acid from sodium sulphate. Phosphoric, hydrobromic, hydriodic, chloric and perchloric acids are also freed from their salts in the presence of wool and an organic acid.

Probably the best explanation of this is on the basis of the equilibrium established in the aqueous solution of the inorganic salt and the organic acid. Undoubtedly there would be a small amount of the mineral acid freed in this manner, which in the absence of wool would, of course, immediately raise the hydrogen ion concentration of the liquor very considerably. But in the presence of wool, an amphoteric compound which unites with acids in an amount more or less corresponding to the hydrogen ion concentration of the liquor, this rise in hydrogen ion concentration would be very materially retarded. As there is really very little free mineral acid present in the solution, that which unites with the wool is probably a large percentage of that ionized. This, of course, would cause more mineral acid to be released to restore the equilibrium, part of which would be in turn fixed by the wool, etc., etc., until equilibrium is established at the temperature of the bath. As far as a catalytic action is concerned, the author can see no true catalytic effect of the wool in this reaction.

In this connection, Robertson, "Physical Chemistry of the Proteins," says that while a protein may not be able to decompose the salt of an acid, binding the acid (or base as the case may be), but, in the presence of a free acid it may be able to do so, partly because the first acid is partially set free from its salt by the second, but also because the ionization of the protein is increased.

Both acids and alkalies are held very tenaciously by the wool fiber. Fort and Lloyd, *J. Soc. Dyers and Colourists 30*, 5-12 (1914), have made a very extensive study of the retention of hydrochloric, sulphuric, oxalic, acetic and formic acids by wool and the amounts of these acids removed on repeated rinsings with water. Table XXX gives their result for hydrochloric acid. Table XXXI for sulphuric acid, and Table XXXII for acetic acid. These tables show that each successive rinsing removes an increasingly smaller portion of acid, until it appears that no more is removed by further rinsing, yet upon treating the wool with an alkaline solution, so as to neutralize it completely, further portions of acid are removed.

The results of these rinsing experiments are hardly as would be expected on the basis of the combination of wool with acids, the isoelectric point of wool, and the hydrolysis of a strong acid with a weak base in aqueous solution. In consideration of these three factors, it would be logical to expect the hydrolysis of the wool-acid compound to proceed to equilibrium with each successive rinse water down to about the isoelectric point of wool, i. e., pH 4.8. If theoretically neutral water is used for the rinsing (pH 7.0), this is comparatively basic as compared with the acidity of the wool, and especially the wool-acid compound. Of course, the removal of the last trace of acid from the wool would be an extremely slow process, and in the presence of the carbon dioxide of the air, the last removal of acid may be obstructed to a slight extent, still on a theoretical basis, it should be possible to rinse the wool free of acid.

TABLE XXX

Amount of Hydrochloric Acid Taken Up by Wool, Amount Removed on Repeatedly Rinsing with Water, and Amount Retained

Acid Used	Acid Absorbed	Rinses (Per Cent) 1st Three	2nd Three	3rd Three	4th Three	5th Three	Total Acid Removed	Acid Permanently Retained
1%	0.977%	0.184	0.072	0.061	0.030	....	0.347%	0.630%
2	1.507	0.481	0.236	0.133	0.022	....	0.922	0.585
3	1.973	0.699	0.308	0.175	0.082	....	1.264	0.709
4	2.315	0.894	0.390	0.205	0.041	....	1.530	0.785
5	2.247	0.951	0.380	0.205	0.103	....	1.639	0.608
6	2.404	0.980	0.390	0.205	0.112	....	1.687	0.717
7	2.472	1.066	0.387	0.187	0.134	0.067	1.841	0.631
8	2.711	1.106	0.427	0.200	0.147	0.073	1.953	0.758
9	2.402	1.082	0.387	0.214	0.140	0.067	1.890	0.512
10	2.587	1.106	0.440	0.220	0.140	0.067	1.973	0.614
11	2.812	1.195	0.454	0.234	0.140	0.073	2.076	0.736
12	2.691	1.189	0.454	0.227	0.147	0.057	2.084	0.607

TABLE XXXI

Amount of Sulphuric Acid Taken Up by Wool, Amount Removed on Repeatedly Rinsing with Water, and Amount Retained

Acid Used	Acid Absorbed	Rinses (Per Cent) 1st Three	2nd Three	3rd Three	4th Three	Total Acid Removed	Acid Permanently Retained
1%	0.972%	0.083	0.055	0.028	0.028	0.193%	0.779%
2	1.903	0.165	0.110	0.097	0.055	0.427	1.476
3	2.669	0.386	0.220	0.165	0.138	0.910	1.759
4	3.579	0.648	0.317	0.220	0.179	1.464	2.115
5	3.483	0.731	0.345	0.220	0.220	1.516	1.967
6	3.862	0.993	0.414	0.331	0.220	1.958	1.904
7	3.718	0.897	0.377	0.215	0.143	1.631	2.087
8	3.803	0.990	0.430	0.197	0.143	1.760	2.043
9	3.620	0.933	0.413	0.215	0.143	1.702	1.918
10	3.794	1.004	0.413	0.215	0.161	1.792	2.002
11	4.167	1.076	0.466	0.233	0.161	1.936	2.231
12	4.055	1.166	0.448	0.233	0.179	2.026	2.029

TABLE XXXII

The Amount of Acetic Acid Taken Up by Wool, Amount Removed on Repeatedly Rinsing with Water, and Amount Retained

Acid Used	Acid Absorbed	Rinses 1st Three	2nd Three	Total Acid Removed	Acid Permanently Retained
1%	0.730%	0.067%	0.034%	0.101%	0.629%
2	0.936	0.152	0.051	0.203	0.733
3	0.973	0.203	0.051	0.254	0.719
4	1.348	0.237	0.051	0.288	1.060
5	1.268	0.304	0.051	0.356	0.912
6	1.187	0.304	0.051	0.355	0.832
7	1.090	0.355	0.051	0.406	0.684
8	1.245	0.490	0.051	0.541	0.704
9	1.298	0.570	0.051	0.621	0.677
10	1.388	0.608	0.051	0.659	0.729
11	1.408	0.574	0.051	0.625	0.783
12	1.400	0.709	0.051	0.760	0.640

The fact that it is impossible to completely rinse the ash out of wool may be taken as an indication that the acid should be largely removed. It would never be possible to rinse wool, by means of water, to a pH of less than 7.0. But by means of an acid rinse (pH probably less than 4.8), it is possible to reduce this alkaline ash to a very low figure and probably the ash remaining is very high in silica.

Woodmansey, *J. Soc. Dyers and Colourists 34*, 172-5 (1918), reports that on acidifying a 5-gram sample of crossbred serge cloth and then extracting it with 250 c.c. quantities of water, the amount of acid removed, expressed as cubic centimeters of 0.01 normal sulphuric acid, were as shown in Table XXXIII.

TABLE XXXIII

Sulphuric Acid Removed from Crossbred Serge Cloth on Extraction

	With Cold Water	Boiling Water
Original acid content (0.01 N H_2SO_4)	53.20	53.15
First extraction	6.85	7.90
Second extraction	3.28	3.55
Third extraction	2.81	3.15
Fourth extraction	2.21	2.48
Fifth extraction	1.50	2.17
Total acid extracted	16.65	19.25
Acid remaining in cloth	36.55	33.90

Prof. Olney, "Textile Chemistry and Dyeing" (1914), page 35, says that dilute mineral acids, such as sulphuric, hydrochloric and nitric, have no appreciable effect upon the wool fiber, although they are absorbed and retained with great tenacity and are not readily extracted even with boiling water. Dilute acids may be dried upon the fiber even at high temperatures without any noticeable tendering, as in carbonizing. Wool soon begins to disintegrate in concentrated acids but in no case is the action as destructive as on cotton. When warmed with dilute sulphuric or hydrochloric acid, the wool becomes more harsh to the touch.

W. Harrison, *J. Soc. Dyers and Colourists 34*, 57-8 (1918), obtained quite different results from those of Fort and Lloyd on the retention of acid by wool and states that sulphuric acid is completely removed from wool by repeated extraction with hot water. He boiled 5 grams of wool in 300 c.c. of water containing 4.90 per cent of sulphuric acid, on the weight of the wool. After cooling, the wool was removed, rinsed well in cold water and packed tightly in a glass extraction tube. The unabsorbed acid in the original solution was determined, and the wool treated with 300 c.c. of boiling water by pouring it through the tube of wool. Twenty-four extractions were made in this manner and the amount of acid removed by each extraction was determined by titrating the water. Table XXXIV gives the results. Before starting to extract the wool it contained 3.08 per cent of sulphuric acid, while the aqueous treating solu-

tion retained 1.82 per cent of acid, on the weight of the wool.

TABLE XXXIV

Percentage of Sulphuric Acid Remaining in Wool After Aqueous Extraction

Number of Wash	Acid in Wool (by difference)	Acid in the Aqueous Extract (on wt. of wool)
Before washing	3.080%	1.820%
1	1.930	1.150
2	1.430	0.500
3	1.160	0.270
4	0.980	0.180
5	0.830	0.150
6	0.700	0.130
7	0.600	0.100
8	0.510	0.090
9	0.430	0.080
10	0.365	0.065
11	0.310	0.055
12	0.265	0.045
13	0.225	0.040
14	0.190	0.035
15	0.155	0.035
16	0.125	0.030
17	0.100	0.025
18	0.075	0.025
19	0.055	0.020
20	0.035	0.020
21	0.020	0.015
22	0.010	0 010
23	0.000	0.010
24	0.000	0.000

Harrison's results are strongly criticized by Fort, *J. Soc. Dyers and Colourists 34,* 124-6 (1918), who questions the purity of the water used in the extractions, but inasmuch as the acid in each extraction was determined by titration, it appears improbable that the water used could have been alkaline. Among technical men the idea appears to prevail that sulphuric acid cannot be completely rinsed from wool. Harrison does not state what indicator he used in this work. For his reply to Fort, see *J. Soc. Dyers and Colourists 36,* 17-8 (1920).

Schofield, "Wet Processes of the Wool Industry" (1924), page 41, in discussing Harrison's work says that apparently H. did not make any investigation, beyond titration, as to whether the extractions were bringing any other constituents away, that is, products of hydrolysis or "wool gelatin." It is evident that if the sulphuric acid were removed from the wool still in combination with an amino acid or even peptide, on titration with an indicator such as Methyl Orange, it would appear as free sulphuric acid.

Jalade, *J. Soc. Leather Trades Chem. 8,* 263-70 (1924), extracted 10 grams of finely divided acid treated wool with three successive 200 c.c. portions of boiling distilled water. The extracts were evaporated to dryness on the water bath, the residue heated for twenty minutes at 105 deg. Cent., and extracted with 20 c.c. of absolute alcohol. The alcoholic extract was evaporated in the presence of distilled water and the hydrochloric and free sulphuric acid was determined in the solution. The residue insoluble in alcohol contains sulphates. The figures obtained in this way varied from 0.50 to 0.08 per cent of sulphuric acid. The three extractions with boiling water did not extract all the free acid, and experiments are quoted to show that while eight washings with boiling water extracted a larger quantity of free acid, even then the residue was still acid. Material which had been extracted with boiling water was dried and extracted with absolute alcohol, but no trace of free sulphuric acid could be removed. J. believes that water hydrolyzes some wool-acid compound, and that wool and pelt are analogous in composition and behavior with regard to sulphuric acid. Eitner does not consider that the acid combined with leather in this way is harmful, and J. found that the tensile strength of wool has no relation to the acid it contains, which coincides with Eitner's views. It has recently been shown by Wilson and Kern, Philadelphia convention of the American Chemical Society, that the deleterious action of 4 per cent of sulphuric acid in leather is much increased by the presence of water.

Wilson and Lines, *J. Amer. Leather Chem. Assoc. 21,* 299-302 (1926), have shown that the combined sulphuric acid may be rinsed out of leather due to the hydrolysis of the acid sulphate, by a continuous washing process with either tap or distilled water; however, it appears to be rather a long washing process in most cases and hardly applicable to the usual industrial processes on textile materials. On the other hand, the chromium in chrome tanned leather is resistant to washing.

This result appears to support the statement previously made (in connection with Lloyd's work above), that while theoretically it should be possible to rinse the wool free of acid, it would be impossible to rinse it free of ash, with water of pH 7.0. Very probably the difficulty experienced in accurately determining the acid or alkali present in wool, by the older methods of analysis, played an important part in the discordant results obtained by the various able investigators. With the newer analytical methods now available, we may undoubtedly look for some accurate and very reliable results along this line.

A Color Reaction

P. Waentig, *Text. Forschg. 1,* 59-63 (1919), found that when boiling 50 per cent sulphuric acid or fuming hydrochloric acid is poured on wool, to which a trace of sugar has been added, in a porcelain dish, a red coloration appears after standing for some time. If the addition of the sugar is omitted and the wool is as far as possible free from fat, a faint rose color results. When the wool contains fat a brown color is produced. In the presence of considerable quantities of cellulose or material yielding furfurol, the red color is produced without addition of sugar, and more intensely. Pure wool gives either no color or a faint red color with strong acids.

Half-wool gives a more or less distinct red color, and pure silk behaves in the same manner as wool. It has been suggested that this may serve as a quick rough method of detecting or estimating the amount of animal fiber in the presence of vegetable fibers on rayon.

Wool Damage

After investigating the action of acids on wool, M. Becke, *Textilber. 2,* 194-5 (1921), says that when treated with acids wool acquires an acidic character so that its resistance to treatment with alkalies is diminished. He found that when wool samples were steeped for two hours in solutions containing respectively hydrochloric, sulphuric, oxalic, formic and acetic acids, 0.9, 0.4, 0.4, 0.225, and 0.1 per cent of the wool was dissolved. When the samples were washed, dried overnight, neutralized with a very dilute solution of sodium bicarbonate, and boiled two hours in a 4 per cent, on the weight of the wool, solution of Marseilles soap, a further 1.8, 2.0, 1.35, 1.15 and 1.0 per cent loss of wool substance occurred.

When different samples of wool were immersed for two hours in solutions containing 0, 2.0, 4.0, 6.0, 8.0, and 10 per cent, respectively, of sulphuric acid, whereby 0.35, 0.20, 0.45, 0.75, 1.10 and 1.50 per cent of wool dissolved, and were then washed, neutralized in a dilute solution of sodium bicarbonate, and heated for two hours at 95 to 100 deg. Cent., in a solution containing 2.5 per cent of sodium carbonate, a further 1.2, 1.8, 3.0, 4.4, 5.2, and 7.6 per cent of wool dissolved. When samples of wool, after immersion in solutions containing 4 per cent of sulphuric acid and 0, 10, 25, 50, 100 and 200 per cent of Glauber salt, whereby 0.45, 0.375, 0.35, 0.3, 0.275 and 0.2 per cent of wool dissolved, were treated with a 4 per cent solution of soap at 95 to 100 deg. Cent., a further 2.0 to 1.9 per cent of wool dissolved. Under the same conditions, except that 5 per cent of acetic acid, instead of 4 per cent of sulphuric acid, and sodium acetate instead of the sulphate, were used, 0.10, 0.125, 0.2, 0.24, 0.25 and 0.25 per cent of wool dissolved, and in the subsequent soaping, 1.2 to 1.3 per cent of wool was dissolved.

A consideration of the losses of wool substances involved in Becke's work shows very nicely the effect of the hydrogen ion concentration of the aqueous solution on the fiber loss in weight. In every case, the acid solutions of the highest hydrogen ion concentration caused the greatest loss in weight, both directly and in the subsequent alkaline treatment. The other acid solutions caused both direct and subsequent losses roughly proportionately lower, as compared on their hydrogen ion concentration basis. Notice the reduction in fiber loss with 4 per cent sulphuric acid as the ionization of the acid in solution is retarded by increasing amounts of sodium sulphate; and the lower losses with acetic than with sulphuric acid.

In a later paper Becke, *Textilber. 2.* 213-5, 230-1 (1921), strongly condemns the use of mineral acids on wool. He claims that in the carbonizing process upon piece goods, the loss in weight of the wool may exceed 3 per cent with a durability loss of 30 per cent. He strongly recommends the substitution of acetic acid and sodium acetate, in place of sulphuric acid and Glauber salt where possible in dyeing and related processes. While this method does not exhaust the dye bath as well as the sulphuric method, the leveling and penetration are usually better, as well as the fastness to rubbing. He states that very fast colors are obtained on wool dyed with Eosin, Alizarine Yellow GGW, Naphthazarine, Eriochromazurol B, Chromotrope 2R, Fast Acid Blue R, Rhodamine B Extra, Diamine Brown, etc., dyed only with acetic acid and sodium acetate, by aftertreatment with copper sulphate. In some cases he obtained better fastness, especially to light, in this way than by afterchroming.

Seel and Sander, *Z. angew. Chem. 29,* 261-5 (1916), believe that any chemical damage to the wool fiber, such as would depreciate its technical value, may be detected by microscopical examination at a magnification of 700 to 1,000 diameters; however, this appears to be somewhat doubtful. They say that wool may be boiled with one per cent sulphuric acid for an hour or more, under conditions comparable with those of the acid and chrome mordant dye baths, without sensible damage, and that microscopical examination reveals no structural modification of the fiber. This latter statement appears to be sufficient to disprove the first statement as undoubtedly there is a slight chemical action on the wool fiber if the hydrogen ion concentration of the solution is not very close to a pH of 4.8.

Matthews' "Textile Fibers" (1924), page 146, says that when wool is treated with dilute acids, the fiber does not appear to undergo any appreciable change; although, from the fact that acids are very readily absorbed by wool and very tenaciously held by it, there is reason to believe that some chemical combination takes place between the fiber and the acid. He believes that this combined acid cannot be completely rinsed from the fiber by neutral water and cites the fact that the acid treated wool has the power of combining with acid dyestuffs without the addition of further acid. Wool that has been treated with warm dilute sulphuric acid solution not only shows an increased affinity for the acid dyes, but has a decreased affinity for the basic dyes. This is exactly as would be expected according to the chemical theory of dyeing. He points out that the other acids have about the same effect on wool as sulphuric acid. As evidence of the chemical action of acids on wool, he points out that ammonium sulphate is found in the aqueous sulphuric acid solution after boiling wool in it.

Trotman and Trotman, "Bleaching, Dyeing and Chemical Technology of Textile Fibers" (1925), page 199, say that wool is dissolved by concentrated mineral acids. Strong nitric acid dissolves it immediately with the copious evolution of nitrous fumes and the solution has a yellow color. Sulphuric and hydrochloric acids act more slowly when cold, but dissolve wool rapidly when heated.

Cold dilute mineral acids have but little action on wool, but nitric acid turns it yellow owing to the formation of xanthoprocteic acid. T. and T. state that formic and acetic acids cause no loss of tensile strength even at 100 deg. Cent. (212 deg. Fahr.) when in the dye bath.

When dissolved in strong sulphuric acid, wool yields a product which has the property of precipitating the acid dyestuffs from solution. The product from solution in hydrochloric acid is less active in this way than that from sulphuric acid. Raikow, *Chem. Ztg.* (1905), page 900, states that wool is almost completely dissolved by the long continued action of phosphoric acid.

The fact that both wool and silk are injured less by treatment in a slightly acid aqueous solution than in pure "neutral" water is rather well known and has been mentioned in the literature. It is readily understood when we consider that the isoelectric points of both proteins (fibers) are on the acidic side of the neutral point of water, pH 7.0. In "Protein Compounds"* we saw how the protein compounds (alkali proteinates and protein-acid) were more soluble in water than the pure or isoelectric protein. In fact, all proteins are less soluble in water at the isoelectric point than at any other hydrogen ion concentration. For this reason, the nearer the hydrogen ion concentration of the solution approaches the isoelectric point of wool, pH 4.8, the less will be the injury to the fiber in any wet process.

Someone has shown that the ash content of "wool gelatin" is higher than that of the fiber from which it was removed. Probably the gelatin, in this case at least, consists of some constituent of the wool in combination with alkali, which is soluble in water. As both ordinary and softened water usually contain some alkaline material, either as hardness or from the softening process, each succeeding rinse would remove more wool-alkali compound. But as the isoelectric point of the wool is approached, less and less of this compound is formed, due to decreased ionization of the protein. Therefore the wool is injured less in a dilute acid solution than in "pure" water alone. As will be pointed out in a later paper, the action of dilute alkali solution is just the reverse of that of dilute acid solutions on wool, and cause a serious disintegration of the fiber. This, as will be readily seen, is in full accord with the above explanation.

However, as the concentration of the acid increases and as the hydrogen ion concentration of the aqueous solution increases (that is, the pH decreases from 4.8), the destructive action of the acid upon the wool rapidly increases, and at high concentrations it usually exceeds that of the higher concentrations of aqueous alkaline hydroxides. These concentrated caustic solutions have less hydrolytic action on the wool fiber than more dilute solutions, but this will be considered in detail in a later paper on the effects of the alkalies on wool.

Further information upon the action of acids upon wool and its chemical combination with the fiber will be found in the papers upon wool dyeing, the damage of wool in various processes, etc., as well as in the foregoing papers of this series, particularly those on "Protein Compounds."

(*This completes the tenth paper on "Wool" by Chas. E. Mullin. The next paper will deal with the action of the individual acids on wool. It will appear in an early issue.*)

*American Dyestuff Reporter, August 23, September 6 and 20, 1926.

DYERS' SOCIETY TO HEAR TALK ON DYE FASTNESS

The interesting story of Germany's work in standardizing dye fastness will be related in an address to be given in February by Dr. Paul Krais before the West Riding section of the British Society of Dyers and Colourists. Dr. Krais is coming from Germany especially to address the society on this important subject, which has aroused such wide interest among color chemists and technologists of several nations.

TEXTILE SECTION OF SAFETY COUNCIL PLANS FUTURE WORK

The Fifteenth Annual Congress of the National Safety Council, held at Detroit, October 25 to 29, attracted 5,000 people drawn from more than twenty industrial divisions. The Textile Section was represented by a large delegation. Many constructive measures were suggested and plans for future activities formulated. The following men were chosen to hold office in the Textile Section during the ensuing business year:

Chairman, G. W. Cook, supervising engineer, the Travelers' Insurance Company, Hartford, Conn; vice-chairman, R. B. Sherman, employment manager, United States Finishing Company, Norwich, Conn.; secretary, H. C. Washburn, safety engineer, Fisk Rubber Company, New Bedford, Mass.; chairman Membership Committee, H. W. Donald, district manager, Engineering Department, American Mutual Liability Insurance Company of Boston, Poston, Mass.; chairman Statistical Committee, Harvey Saul, Employment Director, United States Finishing Company, Providence, R. I.; chairman Bulletin Committee, Ignatius MacNulty, safety engineer, American Woolen Company, Andover, Mass.; chairman Program Committee, Dr. G. H. Van Emburgh, Jr., medical director, Clark Thread Company, Newark, N. J.; chairman Publicity Committee, Dr. R. P. Knapp, medical director, Cheney Brothers, South Manchester, Conn.

Dr. Walter M. Scott, for many years chief chemist at at the plant of Cheney Brothers, South Manchester, Conn., will resign about the first of the year to become connected with the National Aniline & Chemical Co.

Foreign Dyes Imported Through New York and Other Ports During October

Compiled by the Chemical Division of the Bureau of Foreign and Domestic Commerce in Collaboration with the Chemical Division of the United States Tariff Commission

KEY TO ABBREVIATIONS OF MANUFACTURERS' NAMES

1—THE SIX LEADING GERMAN COMPANIES

IG—Interessen-Gemeinschaft der Farbenindustrie.
A—Actien-Gesellschaft fur Anilin-Fabrikation, Berlin. Founded 1873.
B—Badische Anilin-und-Soda-Fabrik, Ludwigshafen-on-the-Rhine. Founded 1865.
By—Farbenfabriken, vormals Friedr. Bayer & Co., Leverkusen-on-the-Rhine. Founded 1862.
C—Leopold Cassella & Co., Frankfort-on-the-Main. Founded 1870.
K—Kalle & Co., A. G., Biebrich-on-the-Rhine. Founded 1870.
M—Farbwerke, vormals Meister Lucius & Bruning, Hochst-on-the Main. Founded 1862.

2—THE SMALLER GERMAN COMPANIES

BK—Leipziger Anilinfabrik Boyer & Kegel, Furstenberg, near Leipzig. Founded 1882.
CG—Chemikaliewerk Griesheim G. m. b. H., Griesheim-on-the-Main. Founded 1882.
CJ—Carl Jager G. m. b. H., Anilinfarbenfabrik, Dusseldorf. Founded 1823
GrE—Chemische Fabrik Griesheim-Electron, Offenbach-on-the-Main. Founded 1842.
L—Farbwerk Mulheim, vormals A. Leonhardt & Co., Mulheim-on-the-Main. Founded 1879
tM—Chemische Fabriken, vormals Weiler ter Meer, Uerdingen-on-the-Rhine. Founded 1877.
WD—Wulfing, Dahl & Co., A. G. Barmen. Founded 1842.

3—SWISS COMPANIES (ALL AT BASEL)

DH—Farbwerke vormals L. Durand, Huguenin & Co. Founded 1871.
G—Anilinfarben-und Extract-Fabriken, vormals Joh. Rud. Geigy. Founded 1764.
I—Gesellschaft fur chemische Industrie. Founded 1885.
S—Chemische Fabrik, vormals Sandoz & Co. Founded 1887.

4—DUTCH AND FRENCH COMPANIES

FA—Farbwerk Ammersfoort, Ammersfoort, Netherlands. Founded 1888
NF—Niederlandische Farben-und-Chemikalienfabrik Delft, Delft, Netherlands. Founded 1897.
CN—Compagnie Nationale de Matieres Colorantes et Produits Chimiques. Founded 1917. (Etablissements Kuhlmann merged with this company in 1923.)
P—Societe Anonyme des Matieres Colorantes et Produits Chimiques St. Denis (formerly A. Poirrier). Founded 1830.

5—ENGLISH COMPANIES

Bro—Brotherton & Co., Ltd., City Chambers, Leeds.
BAC—British Alizarine Co., Ltd., Manchester
BD—British Dyestuffs Corporation, Ltd., London.
Cl Co.—The Clayton Aniline Co., Ltd., Clayton, Manchester.
CV—The Colne Vale Dye & Chemical Co., Ltd., Milnsbridge, Huddersfield.
Hol—L. B. Holliday & Co., Ltd., Huddersfield.
Scot—Scottish Dyes, Ltd., Grangemouth.

FOREIGN coal-tar dyes imported through the port of New York and other ports during the month of October amounted to 460,351 pounds, with an invoice value of $406,167. Imports by ports were as follows: New York, 438,242 pounds, valued at $381,716; Boston, 16,255 pounds, valued at $17,319; Albany, 5,716 pounds, valued at $6,892; St. Louis, 138 pounds, valued at $240.

Imports of Synthetic Dyes

	1926		1925	
	Pounds	Invoice Value	Pounds	Invoice Value
January	190,459	$184,018	403,984	$359,376
February ..	479,027	477,255	373,259	365,268
March	487,804	435,891	527,964	488,501
April	437,526	401,606	451,005	426,141
May	392,739	343,745	370,271	347,904
June	333,319	317,896	376,668	333,654
July	351,425	303,079	420,849	400,366
August	380,414	298,159	330,674	303,612
September .	387,533	322,446	298,858	285,642
October	460,351	406,167	537,312	471,466
Total 3,900,597		3,490,262	4,090,844	3,781,930

Five Leading Dyes, by Quantity, Imported During October, 1926

	Pounds
Indanthrene Golden Orange G (single strength)	14,856
Brilliant Indigo 4B (single strength).....	14,460
Ciba Red R Paste.....	14,328
Rhodamine B Extra (single strength).....	13,850
Alizarine, Synthetic	11,265

Dyes and Intermediates Remaining in Bonded Customs Warehouse

	Coal-Tar Dyes and Colors (pounds)	Coal-Tar Intermediates (pounds)
January 31, 1926.....	703,159	763,409
February 28, 1926.....	596,154	855,170
March 31, 1926.....	447,588	896,530
April 30, 1926.....	359,164	928,593
May 31, 1926.....	535,226	946,120
June 30, 1926.....	671,396	772,475
July 31, 1926.....	512,186	781,796
August 31, 1926.....	557,852	690,031
September 30, 1926.....	395,535	590,520

Pert Cent of Dyes by Country of Shipment

	1926			
	Oct.	Sept.	Aug.	July
Germany	48.0	50.0	47.0	60.0
Switzerland	30.0	30.0	34.0	30.0
France	6.0	3.0	2.5	2.7
England	5.0	5.0	0.5	1.4
Belgium	4.0	3.0	5.5	4.0
Canada	5.0	7.0	8.5	—
Italy	2.0	2.0	2.0	1.5
Holland	—	—	—	—
All other	—	—	—	0.4

The dyes in this report are grouped by both Colour Index and Schultz numbers, and, in the case of those which could not be identified by either number, the classification according to the ordinary method of application was adopted. As the pastes and powders of the vat dyes vary widely in strength and quantity, each vat dye has been reduced—in nearly every case—to a single-strength basis.

DYES OF COAL-TAR ORIGIN

Colour Index No.	Schultz No.	Name of Dye and Mfr.	Quantity (pounds)
16	137	Fast Yellow S—(IG)	300
32	182	Brilliant Sulphon Red B—(S)	
		Brilliant Sulphon Red 10B—(S)	1,500
40	58	Chrome Orange R—(DH)	110
44	56	Nitrosamine Red Paste—(IG)	500
53	61	Victoria Violet 4BS—(Q)	10
124	129	Chromazone Red New Conc.—(G)	220
130	121	Erika B Conc.—(S)	700
196	175	Acid Ponceau E—(G)	220
252	227	Cotton Scarlet Extra—(IG)	100
266	240	Red JB (James Red B)—(IG)	150
278	—	Benzo Fast Red 8BL—(IG)	
		Chlorazol Fast Red K—(BD)	640
288	256	Sulphoneyanine G—(IG)	1,988
307	265	Acid Milling Black B—(G)	2,205
316	273	Blue NA—(IG)	
		Diaminogene Blue NA—(C)	
		Diazamine Blue BR Conc.—(S)	8,920
319	—	Benzo Fast eliotrope BL—(IG)	500
325	—	Brilliant Benzo Violet B—(By)	582
326	279	Benzo Fast Orange WS—(By)	
		Benzo Fast Scarlet 5BS—(IG)	
		Benzo Fast Scarlet 8BS—(IG)	900
327	279	Benzo Fast Scarlet 4BS—(By)	954
331	283	Bismarck Brown S—(S)	10
341	291	Azo Alizarine Bordeaux W—(DH)	5
346	296	Cotton Yellow GX—(B)	40
371	308	Developing Black OT—(C)	180
382	319	Chloramine Red B—(S)	
		Chloramine Red 3B—(S)	
		Diamine Scarlet 3B—(IG)	6,015
387	322	Trisulphon Violet B—(S)	10
409	339	Diamine Orange B—(IG)	100
430		Polar Red G Conc—(G)	
		Polar Red R Conc.—(G)	4,410
436	358	Acetopurpurine 8B—(M)	
		Chlorantine Brilliant Red 8B Conc.—(S)	
		Chlorantine Red BN—(I)	3,093
440	360	Ignamine Orange R—(IG)	200
441		Chromocitronine R—(DH)	441
449	364	Diazo Brilliant Black B—(IG)	1,000
459	373	Congo Orange R—(IG)	1,000
473	387	Columbia Blue G—(IG)	100
487	400	Acid Anthracene Red 3B—(IG)	
		Brilliant Milling Red R—(IG)	1,000
518	424	Chloramine Sky Blue FF—(S)	10
577	457	Trisulphon Brown 2G—(S)	3,012
596	476	Benzo Chrome Brown G—(IG)	200
632	18	Diaphenyl Fast Yellow 4GL Conc.—(G)	55
636	19	Fast Light Yellow 3G—(S)	1,024
653	—	Pyrazol Orange G Conc.—(S)	1,000
654	—	Diazo Fast Yellow 2G—(By)	500
658	496	Rhoduline Blue 6G—(IG)	400
663	500	Setocyanine—(G)	110
667	503	Erio Viridine B Supra I—(G)	
		Poseidon Green SGX—(IG)	5,602
670	505	Acid Green Conc.—(M)	220
671	506	Erioglaucine AP—(G)	
		Erioglaucine X High Conc.—(G)	11,022
672	507	Xylene Blue XS Conc.—(S)	1,000
673	508	Brilliant Acid Blue NAS—(CN)	2,205
677	512	Magenta AB—(IG)	2,000
681	516	Crystal Violet Extra Powder—(IG)	500
682	518	Ethyl Violet—(IG)	400
692	524	Magenta S—(IG)	100
699	531	Eriocyanine AC—(G)	2,205
704	536	Alkali Blue 4R—(K)	189
707	539	Soluble Blue T—(IG)	
		Water Blue—(IG)	800
710	541	Brilliant Dianil Blue 6G—(IG)	400
712	543	Brilliant Acid Blue V—(By)	
		Poseidon Blue BGX Conc.—(IG)	1,000
714	545	Brilliant Acid Blue A—(IG)	
		Poseidon Blue BR Conc.—(IG)	
		Poseidon Blue BXX Conc.—(IG)	2,250
715	546	Blue Extra—(IG)	
		Cyanol Extra—(C)	2,820
717	548	Acid Violet 6BNG—(G)	
		Acid Violet 6BNOO—(IG)	520
720	551	Brilliant Blue G—(By)	
		Chromoxane Brilliant Blue G—(By)	
		Eriochrome Azurol BC—(G)	2,659
727	557	Chrome Violet—(G)	
		Chrome Violet CG—(DH)	220
729	559	Victoria Blue B Base—(IG)	
		Victoria Pure Blue BO—(IG)	1,800
735	564	Alkali Fast Green 3G—(IG)	
		Erio Green B Supra—(G)	
		Naphthalene Green V—(M)	3,547
748	579	Sulpho Rhodamine B—(M)	
		Sulpho Rhodamine B Extra—(IG)	402
749	573	Rhodamine B Conc. (s. s.)—(G)	
		Rhodamine B Extra (s. s.)—(IG)	
		Rhodamine B Extra (s. s.)—(Q)	13,850
757	580	Fast Acid Violet B—(IG)	100
788	603	Rhoduline Orange NO—(IG)	500
789	—	Patent Phosphine G—(I)	661
793	606	Philadelphia Yellow 2G—(IG)	50
795	607	Runic AL Conc.—(IG)	
		Runic AL Conc.—(B)	520
797	608	Patent Phosphine GRNTN—(IG)	3,400
801	613	Quinoline Yellow—(I)	551
802	—	Quinoline Yellow KT Extra—(IG)	200
815	618	Basic Yellow T—(IG)	500
828	672	Azocarmine GX—(IG)	500
829	673	Azocarmine BX—(IG)	
		Rosinduline 2B Bluish—(K)	1,810

(*Continued on page 799*)

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OCTOBER MEETING OF NORTHERN NEW ENGLAND SECTION

An unusually long and very interesting meeting of the Northern New England Section was held on October 30, 1926, at the Walker Memorial, Massachusetts Institute of Technology, Cambridge, Mass. Thirty attended.

Following the dinner, Chairman Leitch called the meeting to order for a brief period of business related to the Southern Annual Meeting of the Association coming in December. Mr. Claflin, chairman of the Southern Meeting Committee, of this Section, gave instructions as to the proper method to obtain ticket rebates and sought to encourage all who could attend to indicate their intentions early so as to facilitate matters related to obtaining the special cars.

At the conclusion of the business session, the chairman called on Walter Durfee for a demonstration of his "Black Light Box."

After darkening the room, Walter Durfee said as follows:

"The box which you see on the mantelpiece has been arranged to show the affect of contrast on color. The box contains a number of holes or windows illuminated from the inside of the box by a small lamp. I believe that all of you can see some light shining in each of these windows in several degrees of brightness.

"A book by M. E. Chevreul, director of the Dye Works of the Gobelins, etc., was published in English translation in the year 1858, entitled "The Laws of Contrast of Colour," by G. Routledge & Co., New York and London. The author explained that the tapestry maker must not copy into his tapestries the colors which he thought he saw. He must determine what the colors are. If he copies the colors as they *appear* to be, in a picture, the tapestry will be wrong and cause complaints. The false appearance of these colors is due to contrast with other colors.

"Some of these lights which you see on the mantelpiece in the windows of the box will turn black and some of them will turn gray as soon as I alter the contrasting color in the neighborhood. This I shall do by turning on the lights in the room. When the lights are turned on, the walls of the room will have a new color and the same windows which now appear to you as shining, will appear black and gray. After these lights have been made to appear black, the black can again be made to appear bright by simply altering the contrasting colors by turning off the lights of the room. . . ."

After carrying through this experiment, Mr. Durfee explained that the large box which was used was copied from a small instrument used in testing the strength of illumination. Such instruments will indicate the brightness in any room by the number of black and gray spots which they show or conversably the darkness of any room by the number of bright spots they show. The present box itself was prepared by a member of our Section, A. K. Hobby, to whom we owe its successful operation.

After Mr. Durfee had concluded his demonstration Dr. George L. Clark, of the Research Labatory of Ap-

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lied Chemistry, Massachusetts Institute of Technology, was introduced by the Chairman. Dr. Clark gave an absorbingly interesting discourse on the "Application of X-ray in the Texfile Industry." His paper follows:

Application of X-rays in the Textile Industry

By George L. Clark

Department of Chemical Engineering, Massachusetts Institute of Technology

X-rays

The nature and production of X-rays and their utilization in the analysis of crystalline structure are now generally familiar. X-rays are electromagnetic vibrations in the ether, differing from ordinary light only in the wave lengths. A beam of X-rays such as are used for studies of textile fibers has an average wave length about 1/6000 as great as yellow light. The whole range of the electromagnetic spectrum covers in order the shortest and most penetrating cosmic rays, lately measured by Millikan (0.0004×10^{-8} cm.), the X-rays from radium, X-rays, ultraviolet rays, visible light, infra-red rays, Hertzian and radio waves and electric waves.

Ordinarily light is diffracted by a grating consisting of finely ruled lines on glass or metal. Under ordinary circumstances such a grating does not diffract X-rays (except at extremely small grazing angles) because these rays are too short. Nature has provided excellent diffraction gratings for X-rays in the form of crystals. The outer symmetrical form of crystals indicates a very definite orderly interior arrangement of structural units. It is very definitely known now, that the atoms (or ions since they are charged + and —) in a rock salt crystal, for example, are arranged on a cubic lattice, such as is shown in Fig. 1. In this crystal, therefore, there are atom-bearing planes, which are parallel, alike and equidistant from each other. These distances are of the same order of magnitude as the X-ray wave length (1 A.U. or one-hundredth millionth of a centimeter). Consequently the crystal may act as a grating for X-rays. The simple fundamental equation governing diffraction or reflection of X-rays by a crystal is:

$$n\,\lambda = 2d \sin \Theta$$

where n is the order of the reflection (1, 2, 3, etc.), λ is the wave length of the X-ray, d is the distance between the parallel identical planes, and Θ is the angle of incidence (or $2\,\Theta$ the angle of reflection) of the X-ray beam upon this set of parallel planes. It is obvious that an experiment with X-rays will at once disclose whether or not a substance is crystalline and may thus act as a grating. Furthermore, if it is crystalline, it is possible to ascertain the value of d, for this set of planes, provided that the wave length λ is known, by a single experimental measurement of the angle 2 A at which reflection may take place. On the other hand, if the plane distance d is known, then the crystal may be used to analyze a beam of X-rays whose wave lengths are unknown.

Single Crystals

When a beam of X-rays passes through a single crystal, each of the sets of parallel planes with its own particular value of d, picks out a ray with a particular wave length and reflects it at a definite angle. The result is a pattern of spots on a photographic plate placed behind the crystal. Each of the spots on the photograph reproduced in Fig. 2 corresponds to one set of planes spaced at a particular distance apart which is reflecting a ray of wave length in accordance with $n\,\lambda + 2d \sin \Theta$. The so-called Laue photograph is a proof of a single crystal of a definite symmetry or pattern in space of the constituent atom. Three pairs of planes in three directions enclose a small unit-cell parallelepipedon. This cell with its characteristic dimensions is the ultimate unit which possesses the properties of the crystal itself.

Powders

If the specimen is not a single crystal but a fine powder or aggregate of single very small crystals heaped together in chaotic arrangement, X-rays of a single wave length may be used to analyze the crystal structure. A typical result is shown in Fig. 3. Each line in the spectrum corresponds to one set of parallel planes, spaced d A.U. apart, which are turned at the correct angle to the incident beam in many of the small grains in order for dif-

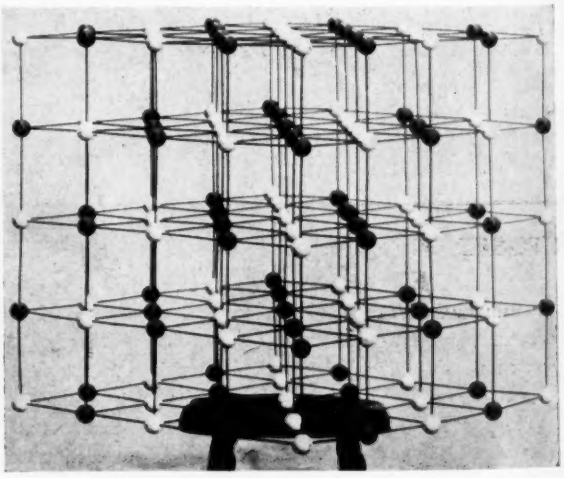

Fig. 1.—*Model of a Crystal Showing Regularity of the Arrangement of Atoms in Space.*

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fraction to occur in accordance with the usual equation. On a flat photographic plate the result would be a series of concentric circles each uniformly intense throughout.

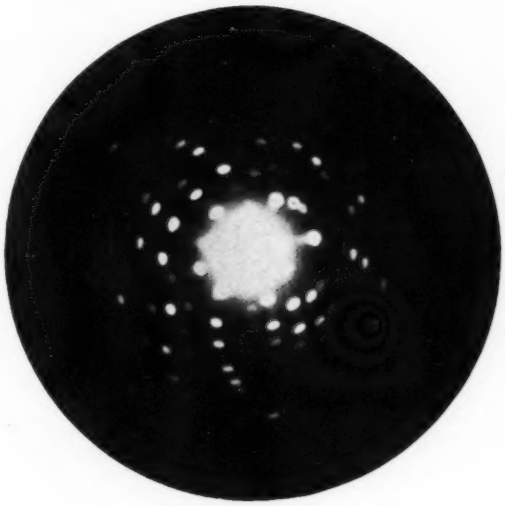

FIG. 2.—*A Typical Result of X-ray Diffraction by a Single Crystal.* (*Laue photograph of an iron crystal.*)

It is at once conceivable that there might be a type of solid matter intermediate between a single perfect crystal giving such a diagram as shown in Fig. 2, and a chaotically arranged powder or aggregate, where typical X-ray diagram is shown in Fig. 3. This intermediate state would be characterized by many small crystals, and instead of being turned in every possible direction, they would be aligned in order in some definite direction. In a fiber, for example, the small crystal units would all be packed together in a perfectly definite arrangement with respect to the fiber axis. There are many examples of crystal fibers in nature, including the textile fibers. The striking X-ray diagram for such a specimen is typified in Fig. 4 for asbestos. The parabolas upon which lie spots or intensity maximum are proof of a perfect fiber. Less perfect "fibering" is always obtained when metals are rolled or drawn, and when many substances are subjected to mechanical working. The result is a material which has directional properties and is not isotropic.

COLLOIDAL AND AMORPHOUS SUBSTANCES

The X-ray diffraction result for materials in which there is no regularity of atomic or molecular structure should be merely a general blackening of the photographic plate. Only a very few substances, mercury, solid alkali metals at relatively high temperatures, etc., give this type of diagram. The great majority of so-called amorphous materials such as liquids, glasses, colloidal gels, give X-ray diagrams characterized by one or more broad, somewhat diffuse, rings, indicative of some kind of incipient or chance arrangement into crystal fragments, or regularity of atomic arrangement within molecules, in spite of the fact that they are called "amorphous bands." The writer's work on carbon blacks has thrown considerable light upon the significance of these results. It is now well established that crystalline materials in the colloidal state (e. g., colloidal gold) give X-ray diffraction spectra with the lines in the same positions as for the same material in massive form. However, the lines are broader in proportion as the colloidal particle size becomes smaller; hence it is possible to calculate particle size from a measurement of the width of the diffraction interference lines, usually taken at the points of half-maximum intensity. As these lines become broader they become less intense since the energy is scattered over a larger area. The result is that the lines farthest out on the photographic plate or film can no longer be detected and a state is reached where only 1, 2 or 3 bands may be seen for the particles which are so small that only a few layers of atoms are available. It has been possible with carbon blacks to proceed continuously from a practically amorphous state through the "paracrystalline" state in which the regular layers of carbon atoms are being formed, at first probably bent or distorted, on to colloidal graphite with sharpening lines and new ones becoming visible, and finally crystals or graphite giving the whole sharp-line graphite diffraction spectrum. These experiments are of direct application in the study of the

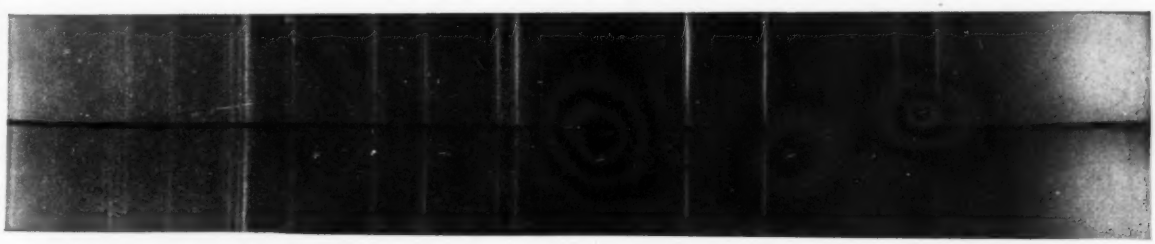

FIG. 3.—*Typical Diffraction Spectrum for Crystal Powders or Aggregates* (*Platinum*).

results with cellulose and related fibers. The fiber crystal diagram for rubber when it is stretched has been considered in a recent paper by the writer.[1]

Information from X-ray Data

It follows from the preceding paragraphs that X-ray photographs, properly interpreted, may yield the following types of information:

1. Crystalline or amorphous.
2. Single crystal or aggregate.
3. Random or fibered aggregate.
4. Crystal structure—lattice type and dimensions.
5. Purity.
6. Particle size (quantitatively measurable with microphotometer).
7. Chemical identity; single substance, mixture, solid solution, adsorption complex.
8. Uniformity of composition and coring of particles.
9. Differentiation between physical and chemical changes (e. g., swelling vs. mercerization).
10. Chemical changes—oxidation, polymerization, etc.
11. Effects of supporting materials or containers.
12. Differentiation between good and bad materials from above standpoints.

[1] Ind. Eng. Chem. 18, 1131 (1926).

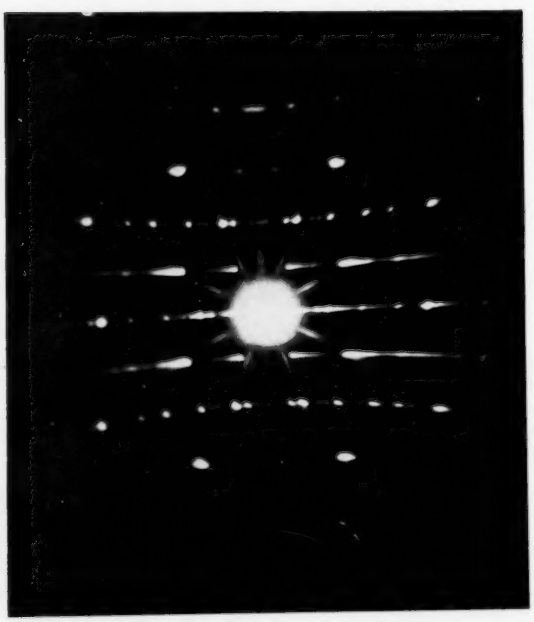

Fig. 4.—*Typical Diffraction Pattern for a Perfect Fiber. (Chrysotile Asbestos.)*

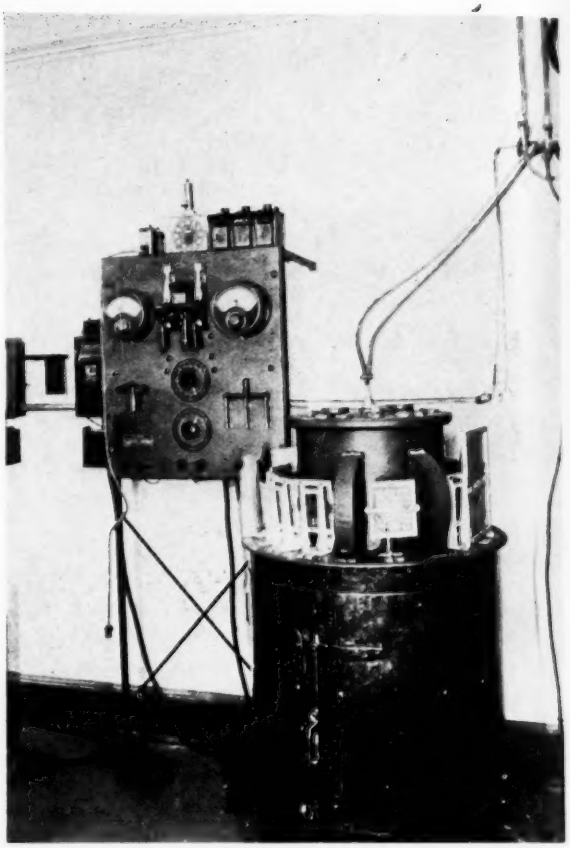

Fig. 5.—*Multiple X-ray Diffraction Apparatus Used in Study of Textile Materials.*

The X-ray Method

Best results in the study of the structure of fibers have been obtained by the pinhole method. A beam of X-rays of practically a single wave length from a copper or molybdenum target tube is defined by two pinholes in lead and then passes through the specimen placed over the outer pinhole. The diffracted rays fall upon a flat photographic plate or film placed at a fixed distance behind the specimen. For powdered dyes, etc., the powder line spectrum (Fig. 3) is best adapted for quantitative studies. The new multiple apparatus used in the writer's work for making eighteen exposures simultaneously is shown in Fig. 5; it has been fully described in a recent paper.[2]

[2] Clark, Brugmann and Aborn. J. Optical Soc. Am. and Rev. Sci. Insts. 12, 379 (1926).

Cellulose

1. C. von Nageli many years ago found that cellulose has the property of doubly refracting light; hence, cellulose possesses something like crystal structure (paracrystalline, or the tendency to have regular arrangement of molecules).

2. Most recently this property has been confirmed by X-ray investigation of natural fibers, celluloses precipitated from various dispersions (viscose, etc.), and their fibers, in the studies of Clark, Lanyon, Freudenthal, and Kulp on cotton, flax, jute, hemp, sisal, ramie (typical diagrams, Figs. 6 and 7), and all varieties of rayon (viscose, Fig. 8).

3. The acetyl derivatives of cellulose can be crystallized from their solutions into very definite crystals with faces.

4. Debye and Scherrer obtained X-ray interference diagrams from cellulose in 1916, confirming indications from (1), (2), and (3).

5. Herzog, Jancke and Polanyi showed that celluloses from different sources produce interferences for the same crystal system and same axial ratios.

6. Herzog in careful evaluation of Debye-Scherrer diagrams found the axial ratios to be 0.6935:0.1:0.4467. The crystal cell, therefore, belongs to the rhombic system.

7. Herzog, with the monochromatic pinhole method, proved that cellulose powder shows diffraction rings; with the beam parallel to the length, fibers show diffraction rings; and with the beam perpendicular to the length of the fibers, they show the fiber diagram. The conclusion is that cellulose fibers consist of crystallites joined end to end throughout the length of the fiber.

8. Depending on the previous treatment, either mechanical or chemical, so does the diagram vary.

9. Herzog and Jancke evaluated the dimensions of the elemental cellulose body as 7.9 by 8.45 by 10.2 A.U.; the calculated number of $C_6H_{10}O_5$ molecules composing the elemental cell is 4. Dore and Sponsler[3] obtained similar results and were able to derive a complete structure upon the basis of an annular fiber and chains of amylene-oxide groups parallel to the fiber axis. This means simply that four hydrated glucose residues are intimately associated in the larger colloidal aggregates which determine molecular weights, etc.

Fig. 6.—*Diffraction Pattern of Sisal Fiber.*

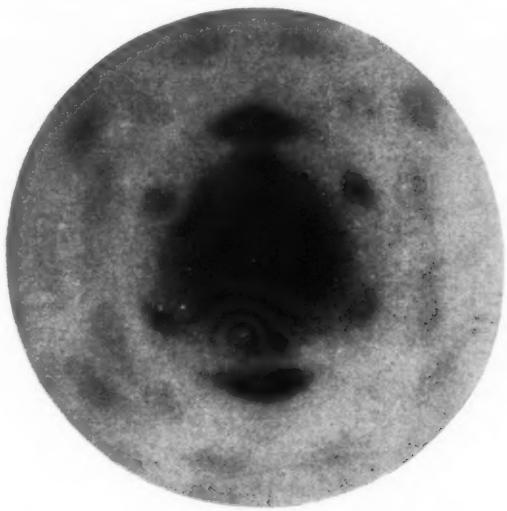

Fig. 7.—*Diffraction Pattern of Ramie Fiber.*

10. According to Mark and Katz, mercerized cellulose no longer shows the cellulose spectrum but new bands are manifested, particularly a doubling of one of the equatorial spots (Fig. 9) on the X-ray diagram corresponding to the (020) planes. That a chemical change occurs in mercerization is further proved by the fact that the infra-red absorption bands are different before and after the process. (Herzog.)

11. With very pure cellulose the original diagram disappears at the same alkali concentration as breaks in Vieweg and Heuser's alkali adsorption curves, corresponding to the formation of $(C_6H_{10}O_5)_2NaOH$ and $(C_6H_{10}O_5)NaOH$.

12. These new bands occur at the same places whether the alkali is NaOH, KOH, or LiOH. There is a possibility, therefore, of conversion of the cellulose to an isomer by the alkali.

13. A similar change occurs with HNO_3 above concentrations of 61 per cent, but not with HCl or H_2SO_4. There is an open question as to the possibility of "cellulose hydrate" formation. The compound $C_6H_{10}O_5 HNO_3$ exists and gives a different pattern. "Philanized" cotton produces the same pattern as ordinary cotton.

14. Sodium hydroxide-alcohol-water solution gives the

[3] Fourth National Colloid Symposium, 1926.

same changes as sodium hydroxide-water solution, but the strength of the alkali in the former case, causing disappearance of the original diagram, does not check the alkali-adsorption curves for sodium hydroxide-alcohol-water solution.

15. When regenerated by thorough washing, cellulose gives the original cellulose diagram, with the lattice enlarged about 4 per cent, and a new band. There is, therefore, only a partial reversion of the swollen material to the original cellulose.

16. No measurable differences are noted in the space lattice of swollen and unswollen cellulose (by non-mercerizing solutions), hydrated cellulose and artificial silk fibers. Swelling is clearly due to inhibition of water between the unit cells.

17. Freudenthal and Kulp working with the writer have established the fact that all cellulose is para-crystalline except the diacetate rayon which is amorphous. The degree of fibering, however, varies widely from a minimum in viscose to a maximum in natural fibers, particularly ramie. Tension on the fiber and the solution dispersion in rayon production have large effects upon the fibering as disclosed by X-ray diffraction.

18. In this investigation, also, it has been found that the impurities are an integral part of the cellulose crystals. Pectins, rosins, etc., incidentally present, do not affect the diagram; the integral impurities are degraded celluloses. Profound changes in intensities of the X-ray diagrams following purification with 1 per cent sodium hydroxide solution are not clearly understood. These observations place, however, serious doubts on the picture of the cellulose crystal units embedded in waxes, rosins and pectins.

19. Again it must be emphasized that the X-ray data differ by their very nature from physical or chemical estimates of molecular or polymer size in cellulose, rubber, gelatin, etc. In every case the unit crystal cell is far simpler than anticipated. This means either that the real molecules are simple but appear in macroexamination colloidal or secondary valence aggregates, or that there are structural periodicities within large, loosely bound molecules which diffract X-rays as if there were layers of discrete molecules.

20. Ott[4] has recently made beautiful pinhole photographs of cellulose and substances all related to the dehydrated glucose residue. The essential results are in Table XXII.

21. Cellulose triacetate and nitrocellulose both give X-ray diffraction patterns characteristic of the rhombic system with unit cell dimensions, respectively, of 9.20 by 7.10 by 7.96 A.U. and 10.10 by 8.56 by 9.77 A.U. The elementary volume V of the front is therefore 631. $\times 10^{-24}$ cm.^{3} If the density S is 1.2 and the molecular weight of $C_6H_7(C_2H_3O_2)_3O_2$ is 288, the number of such molecules is

$$n = \frac{V.S.N.}{M} = \frac{631. \times 10^{-24} \times 1.20 \times 61 \times 10^{22}}{288} = 16$$

The elementary volume for nitrocellulose is 845 $\times 10^{-24}$ cm^3 and the density 1.58, where the number of $C_6H_8(NO_3)_2O_3$ groups is 32.

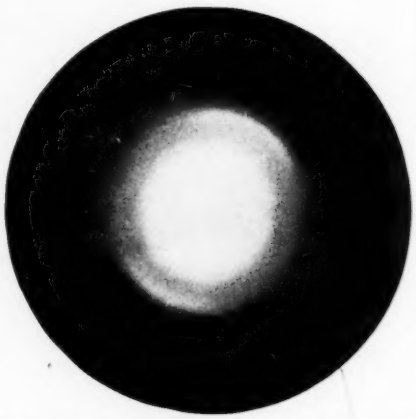

FIG. 8.—*Diffraction Pattern of Viscose Fiber.*

OTHER TEXTILE FIBERS

The protein natural fibers silk (fibroin and sericin) and wool (keratin) also yield diagrams similar to those for cellulose fibers. The field of the practical X-ray examination of textile fibers for information concerning uniformity, dyeing, heat and light aging, effects of chem-

TABLE XXII

Formulas of Cellulose and Related Substances from X-ray Data (Ott)

Substance	Probable Formula	Maximum Spacing, A.U.	Probable Maximum Unit-Cell Formula
Diamylose ...	$(C_6H_{10}O_5)_2$	11.35	$(C_6H_{10}O_5)_{22}$?
Tetramylose .	$(C_6H_{10}O_5)_4$	9.02	$(C_6H_{10}O_5)_{12}$?
Octamylose ..	$(C_6H_{10}O_5)_8$	15.96	$(C_6H_{10}O_5)_{63}$?
Triamylose ...	$(C_6H_{10}O_5)_6$	7.27	$(C_6H_{10}O_5)_6$
Texamylose ..			
Inulin	.....	7.34	$(C_6H_{10}O_5)_6$
Cellulose	$(C_6H_{10}O_5)_4$	6.01	$(C_6H_{10}O_5)_3$
Lichenin	.....	7.69	$(C_6H_{10}O_5)_7$
Starch	$(C_6H_{10}O_5)_2$	5.21	$(C_6H_{10}O_5)_2$

[4] Physik. Z., 27, 174 (1926).

ical reagents and laundering, etc., is still practically untouched but promises much for the textile industry.

Dyes

It is obvious from an examination of the paragraph on the information obtainable from X-ray data, that X-ray methods may be applied with great value in the study of dyes—their crystallinity, particle size, constitution, uniformity from various sources, reproducibility of color as functions of constitution, the nature of their combination with the fiber (whether mechanical, an adsorption complex or chemical compound), chemical changes in fading, effects of alkalies, acids, etc. As already indicated this field of investigation is still practically untouched. Fig. 10 is the X-ray pinhole diagram for Indigo powder, pressed into a slab. This pattern proves that the dye is distinctly crystalline and that the particle size, determined from the width of the diffraction line is of the order of 10^{-6} cm. in diameter. Another interesting phenomenon is that the circles are not complete as they would be if the powder were simply a chaotically arranged heap of the minute crystal grains. There is distinct evidence of "fibering" or arrangement simply by the process of pressing into a slab; in other words, these grains all tend to align themselves in a definite fashion. This is a peculiar attribute of these dyestuff powders, since many other powdered substances would not produce this oriented diagram even though subjected to the same treatment.

Quantitative researches are now in progress upon some of these promising new applications in the textile industry, since the experimental technique has been developed, and fundamntal knowledge concerning the textile fibers has been obtained.

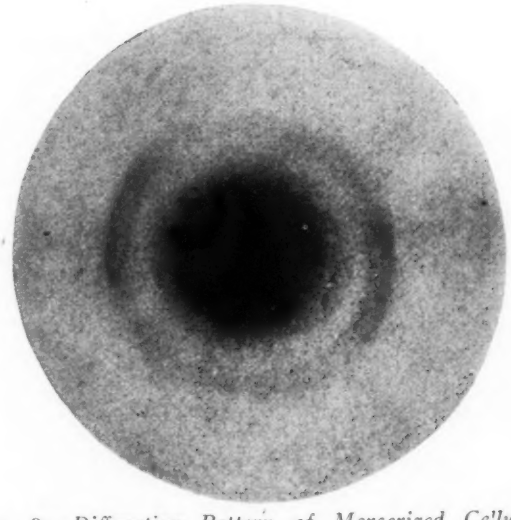

Fig. 9.—*Diffraction Pattern of Mercerized Cellulose Fiber Showing Doubling of Interference Maxima.*

Discussion

Wm. H. Cady—Does the X-ray diagram appear different for mercerized and unmercerized cotton?

Fig. 10.—*Pinhole Diffraction Pattern of Pressed Slab of Indigo Powder.*

Dr. Clark—Distinctly different (see points 10 to 15 under "Cellulose" in text).

Mr. Durfee—Is there difference in arrangement of atoms with varying degree of mercerization?

Dr. Clark—A chemical change, difficult to interpret, undoubtedly occurs in mercerization. The new interference points grow in intensity with the degree of mercerization. These disappear in thoroughly regenerated cellulose but the crystal lattice has expanded 4 per cent. "Philanized" cotton has the same diagram as ordinary cotton.

Mr. Durfee—What I had in mind was that the reason for transparency might be due to rearrangement of atoms or molecules.

Mr. Clark—Undoubtedly correct. It has been experimentally proved that the transparency of layers of long-chain organic compounds may be controlled, depending upon whether the molecules are parallel and stand on end in successive parallel layers, or whether they lie flat or in all directions. This orienting tendency seems to hold for cellulose although there cannot be large changes. The unit for cellulose seems to be $(C_6H_{10}O_5)_4$. The introduction of OH or alkali metal groups gives new diffraction layers in the fibers, and distinctly changed optical properties.

Mr. Durfee—In mercerizing they use tension and also remove soda by washing. This gives a distorted whole and modified light reflection.

Dr. Clark—These have their effect upon the X-ray patterns. There is only partial reversion during washing to the original cellulose diagram.

Mr. Durfee—Tension may have similar effect as in going from a gel to a solid.

Dr. Clark—Tension determines how perfect the fibering or arrangement of para-crystalline units will be, as measured by sharper and more intense spots on the photograph.

Mr. Durfee—Could you have X-ray in control of manufacture or artificial silk or in mercerization?

Dr. Clark—The outlook is very promising; however, the X-ray is primarily a research tool which can be used to discover the facts vouchsafed by no other method and then to enable the establishment of a manufacturing technique which will assure desired properties. X-ray methods are probably too expensive and difficult for ordinary plant control and testing.

Mr. Durfee—Study made after leather is produced or in process?

Dr. Clark—Yes, many phases of the leather industry may be successfully studied. Gelatin and collagen fibers, particularly when stretched, yield fiber diagrams as does rubber when it is stretched. The manufacture of satisfactory patent leather may be controlled by X-ray studies.

Mr. McCool—Do X-rays show whether dyeing, as in wool dyeing, is chemical or mechanical.

Dr. Clark—This is still a virgin field. So far results seem to check optical measurements and suggest chemical combinations. Our ideas of distinct lines of demarcation between absorption, secondary and primary valence are now completely destroyed. In many cases dyeing seems to be so close a combination that it is more than absorption. The dye shows X-ray results no longer as in powder and there are changes in the X-ray diagram of fiber itself. Interesting to note change more profound in annular fibers (hollow middle). Thickness of fiber does not interfere with the study since films only 1/10,000 inches thick containing only 1 or 2 per cent crystalline material give positive results.

Mr. McCool—It appears to be chemical combination?

Dr. Clark—Yes. Dyed cotton, wool, and silk, and rayon indicate nearest thing to, if not, chemical combination although hard to tell from intimate absorption. The dye molecules are at least oriented.

Mr. Durfee—Have you compared surface dyeing and inner absorption of dye?

Dr. Clark—Can study surface only, or interior, as desired. Have made only studies on swelling of fiber, outside and inside.

Prof. Olney—Have you made studies as to size of the fiber crystals and as to the distance apart?

Dr. Clark—Such measurements are most important and may be done with great accuracy (see No. 9 under "Cellulose" in text). In rubber the number of molecules in a diffracting unit is calculated to be four or eight molecules. This unit is not that ordinarily considered by chemists. X-ray data tell that these molecules or particles have 2,000 or more of the ultimate units. As particle size decreases the diffraction curves become broader; for all colloids there are broad lines. From measurements of such lines at points of one-half maximum intensity the particle size may be accurately calculated. [Measuring with microphotometer and galvanometer was described.]

Prof. Olney—Could the difference in the behavior of different types of dyes toward different fibers be explained by fiber crystal distances?

Dr. Clark—The unit "crystal" cells for all cellulose fibers seems to have the same dimensions. If dyes actually entered into these there should be a change in dimensions.

Prof. Olney—Is it possible in the case of cotton that certain dyes, as for instance direct cotton colors, penetrate more readily into the spaces between the fiber crystals, than acid dyes which will not dye cotton at all?

Dr. Clark—Yes. There is much non-crystalline bonding material (pectins, rosins, degraded cellulose) in the fibers. It is known that some solutions, water, etc., are mechanically imbibed between crystalline material and do not affect the crystal diffraction. Swelling is of this type.

Prof. Olney—Is there any way whereby an X-ray examination would indicate whether a dye was actually absorbed by the fiber crystals, or whether it was simply deposited in the space between the crystals?

Dr. Clark—Yes. See answer to Mr. McCool's first question, above.

Prof. Olney—Is there any convenient form of apparatus for carrying on X-ray work with fibers, and if so how much would such a complete working outfit cost?

Dr. Clark—The apparatus in Fig. 5 is designed and built for this purpose. A new General Electric diffraction apparatus (about $2,500) is built along these lines.

Prof. Olney—Ordinary light has a pronounced action upon wool fiber, modifying its dye absorbing properties. Would X-ray exposure cause a more rapid change? We conducted a few experiments at one time with X-rays to determine this but secured no definite results, and so concluded that we did not expose the wool long enough. Have you any reason to believe that the modified dye absorbing properties referred to may be caused by crystal modification rather than some definite chemical change in fiber substance?

Dr. Clark—In cases of this kind X-rays do not, in general, have any effect as compared with visible or ultraviolet light. This has been definitely proved in the photochemical oxidations of benzaldehyde, oils, rubber, etc. The X-rays are so relatively penetrating, because of short

wave lengths that they are not so readily absorbed by matter as is light; absorption of the radiation must obviously precede chemical change. The modified dye-absorbing properties of light-aged textile fibers is due to the processes of oxidation which affect all the materials in the fibers, gutta percha, rubber, etc., age and become brittle, the crystallinity of all materials becomes more strongly marked.

Mr. Durfee—This indicates that wave lengths must have certain magnitude to stretch from one atom to another, getting leverage to act on molecules.

Dr. Clark—The idea is good visualization. It is possible to produce wave length variations by voltage changes according to formula. $Ve = hc/\lambda$, where V is the voltage, λ the wave length and h and e are constants. The maximum voltage thus far used on an X-ray tube is 308,000, giving a minimum wave length of about 0.04×10^{-8} cm. To get $.0004 \times 10^{-8}$ cm. (Millikan cosmic rays) a potential of 3,840,000 volts would be required; such voltages may occur in nature for there are 1,800 thunderstorms in any instant on the earth.

Mr. Grimes—You have shown how electrical energy may be transformed to X-ray energy. Can the process be reversed?

Dr. Clark—Yes. X-rays falling upon matter liberate β-rays or photoelectrons which have definite kinetic energies.

Mr. Grimes—If the material being studied has a large amount of impurity or is a mixture what is the effect?

Dr. Clark—The X-ray graphs will be superposed on same plate and must be deciphered; in cases of solid selection the lattice dimensions of a pure component are changed.

Dr. Chapin—If the specimen is a liquid, are diffraction effects produced?

Dr. Clark—In many cases, yes. Linseed oil gives a sharp picture and its polymerization or its oxidation can be followed closely. All liquids, except mercury, perhaps, give evidence of some kind of regular arrangement of atoms in molecules, or chance arrangement of molecules.

Mr. Landers—Why not use X-rays to analyze alcohols?

Dr. Clark—This is possible. We are doing valuable work for hospitals on body fluids, as indicating lead poisoning, etc.

Mr. Moran—Can you use X-ray on emulsions?

Dr. Clark—Wax, oils and greases give beautiful results. A soap (lead lacceroate) has recently given a spacing of 92 A.U., showing that long chains are standing on end in parallel layers. The ordinary dimensions of crystals are 4 to 8 A.U.

Mr. Christison—How is it possible to obtain monochromatic X-rays?

Dr. Clark—If, for example, a molybdenum target is used a zirconium oxide filter cuts out all but a very close doublet; also by controlling voltage sensibly monochromatic radiation results.

Mr. Moran—Cellulose triacetate is crystalline and diacetate not. If we remove one acetate from triacetate does it lose its crystalline structure?

Dr. Clark—It does lose crystalline structure. This may be compared with the example of benzophenone crystals 3 or 4 degrees below the melting point where faces remain the same but internal structure is lost and no X-ray diffraction for the crystal can be observed.

Mr. Banman—I suggest that the Section save the speaker's voice and use him at another meeting, owing to lateness of hour.

The speaker was accorded a hearty round of applause and a standing vote if thanks, after which adjournment to informal conversation was taken.

NOVEMBER MEETING OF THE RHODE ISLAND SECTION

The November meeting of the Rhode Island Section of the American Association of Textile Chemists and Colorists was held in the rooms of the Providence Engineering Society on Friday evening, November 12, 1926, at 8 o'clock. Walter S. Williams, Chairman, presided.

Dr. Elvin H. Killheffer, vice-president of the Newport Chemical Works, Inc., of Passaic, N. J., was scheduled to be the speaker of the evening. Owing to Dr Killheffer's illness, his assistant, Phillip H. Stott, of the Newport Chemical Works, delivered Dr. Killheffer's paper, which was entitled "Solvents Made by the Hydrogenation Process, Their Manufacture and Some of Their Uses and Applications in the Textile Industry."*

At the conclusion of his address, which was most interesting, there was a discussion, after which a rising vote of thanks was rendered the speaker.

There were forty members present. The meeting adjourned at 9.30 o'clock.

Respectfully submitted,

A. N. DANA, *Secretary.*

Notice to Junior Members

Many of the Junior Members, who have been accepted into membership since the organization of the Association, are now qualified for Active Membership.

If such members, now over twenty-six years of age, feeling that they are eligible for transfer to Active Membership, will communicate with the Secretary, giving an outline of their activities since election, the Council will gladly consider such applications for transfer.

W. E. HADLEY, *Secretary.*

*NOTE.—As Dr. Killheffer's paper was very similar to one he expects to present before the Annual Meeting of the Association in Charlotte, N. C., this week, it is not published with this report. It will appear in full in the Proceedings of the Annual Meeting.

FORTY-FIRST COUNCIL MEETING

The forty-first meeting of the Council of the American Association of Textile Chemists and Colorists was held at the Engineers' Club, Boston, Mass., November 5, 1926, and resulted largely in a joint meeting of the Council and Research Committee, the following members being in attendance: L. A. Olney, E. H. Killheffer, W. C. Durfee, G. A. Moran, W. R. Moorhouse, W. S. Williams, R. F. Culver, H. W. Leitch, W. M. Scott, R. W. Hook, R. E. Rose, W. H. Cady, H. Christison and W. E. Hadley.

Letters of regret at being unable to attend were received from P. J. Wood, A. E. Hirst, and Ed F. L. Lotte.

The following members were admitted to membership:

Active Members

Chasse, Paul, boss dyer. Address: Consolidated Piece Dye Works, Paterson, N. J.

Cole, Rotheus P., manager dyestuff department. Address: Eaton-Clark Company, Detroit, Mich.

Goodavage, J. E., instructor of dyeing. Address: Philadelphia Textile School, Philadelphia, Pa.

Freisinger, Sigmund, silk dyer. Address: Sigmund Freisinger—Silk Dyers, 540 First Avenue, New York, N. Y.

Hass, Walter C., colorist, National Silk Dyeing Company. Address: 416 Ellison Street, Paterson, N. J.

Hauschild, O. E., dyer, William Skinner & Sons. Address: 208 Appleton Street, Holyoke, Mass.

Kapp, Benjamin, consulting chemist, Washine Manufacturing Company. Address: 968 Sherman Avenue, Bronx, N. Y.

Laycock, Joseph G., dyer and finisher, Lowell Bleachery, South Plant No. 2. Address: 585 South Hill Street, Griffin, Ga.

Love, James E., dyer, Marshall Field Corporation. Address: Leaksville, N. C.

Schwarz, Eugene, chemist, General Dyestuff Corporation. Address: 42 West Sixty-ninth Street, New York, N. Y.

Sheldon, Irving, Jr., dyer and finisher. Address: Everett Norfolk Company, Lebanon, N. H.

Junior Members

Ruffenach, Stephen, assistant silk dyer, Schwarzenbach, Huber Company. Address: Box 31, Union City, N. J.

Schroeder, Karl P., laboratory assistant, National Silk Dyeing Company, Paterson, N. J. Address: 41 Lakeview Avenue, Clifton, N. J.

Laurence P. Ryan and Louis I. Fidelgoltz were transferred from Junior to Active Membership.

Regarding the death of Wm. D. Livermore, Vice-President of the Association, the Secretary was instructed to place the following resolution, adopted by the Council, in the minutes of the meeting and send a copy to the family of Mr. Livermore and to the President of the American Woolen Company:

Resolution Passed in Memory of William D. Livermore

Whereas, we, the members of the American Association of Textile Chemists and Colorists, have learned with sorrow of the death of William D. Livermore, one of the founders of this association and a vice-president since its organization; be it

Resolved, That we place on record our appreciation of his services to the Association and particularly to the scientific work of our research committees. He was a man of great experience in textile chemistry and a business administrator of unusual ability.

Mr. Livermore's services to the textile industry of the United States were important and valuable. He has served as chief chemist for the American Woolen Company since its organization, a period of twenty-seven years, and previously for ten years as chemist for the Washington Mills, one of the organizations forming the American Woolen Company, a continuous service of thirty-seven years with the same interest.

The Secretary was instructed to notify the Secretaries of the Local Sections that all papers delivered before Local Sections are the property of the Association and are not to be given out for publication until such time as they have appeared in the Proceedings.

An amendment to the Constitution was presented to

the Council, wherein it was decided to change Article VIII, the suggested amendment being couched in the following terms:

Proposed Amendment to Article VIII

Third Paragraph, omit the words from "Excepting the first election" to "at least ten nominating ballots," and substitute the following:

Not later than July 1 in each year, each section shall elect one of its members to serve on a committee to prepare nominations for the annual election. The local secretaries shall send the names of their respective committee members to the Secretary of the Association, who shall serve as chairman of the Committee without vote. The Committee shall publish in the Proceedings of the Association between October 1 and October 15, at least one nomination for each officer and at least two nominations for Councilor. Counter nominations for any office signed by at least ten members may be filed with the Secretary not later than November 1. The Secretary shall then prepare and issue an official ballot containing the names of all the nominees.

Signed—W. R. Moorhouse, W. H. Cady, W. M. Scott, L. A. Olney, W. S. Williams, R. F. Culver, E. H. Killheffer, R E. Rose, H. Christison, W. C. Durfee, R. W. Hook and G A. Moran.

The application for the formation of a new Southern Section, to be known as the Southwestern Section, was considered. The names of the present Southern Section was changed to the Piedmont Section at the request of the Section. The geographical boundaries of these two sections will be decided at the Annual Meeting. P. J. O'Neil was appointed Secretary *pro tem,* to attend to the organizing of the Southwestern Section.

A great deal of time was spent in the preparation of the program for the coming Annual Meeting. This matter is fully covered in the Program.

Respectfully Submitted,

W. E. HADLEY, *Secretary.*

Resignations

Beasley, Dorald, Mesier Avenue, Wappingers Falls, N. Y.
Sackett, Geo. A., 222 Twin Oak Road, Akron, Ohio.

Applicants for Membership

Active Membership

Barnes, H. A., superintendent Textile Coverting Plant, Proximity Print Works, Greensboro, N. C. Sponsors: R. H. Souther and F. A. Whitney.

Donovan, L. F., superintendent of dyeing, Great Falls Manufacturing Company, Rockingham, N. C. Sponsors: John Hartley and P. L. Sullivan.

MacKinnon, Edward A., assistant sales manager, E. I. du Pont de Nemours & Co., Boston, Mass. Sponsor: Robt. S. Lunt.

Morris, Merrill G., overseer of dyeing, Nassau Felt Mills Brooklyn, N. Y. Sponsors: L. A. Olney and A. K. Johnson.

Post, C. Irving, district sales manager, National Oil Products Company, Charlotte, N. C. Sponsors: Oscar R. Flynn and C. P. Gulick.

Stribling, R. S., chemist and dyer, Southern Bleachery Inc., Taylors, S. C. Sponsors: C. S. Doggett and J. E. Moore.

Changes of Address

Brainard, Carrol L., 24 Orchard Street, Passaic, N. J.
Coyle, F. T., 19 Pastuer Street, Providence, R. I.
Davidson, E. P., 232 West First Street, Charlotte, N. C.
Demers, Wm. J., 1294 Main Street, Worcester, Mass.
Derby, Roland E., R. F. D. No. 3, Lowell, Mass.
Feindel, George P., 101 Whiting Avenue, E. Dedham, Mass.
Furman, Albert, Cold Spring, Putnam County, N. Y.
Hannant, Fred A., 107 Highland Avenue, Fitchburg, Mass.
Martin, John J., 333 Adelphi Street, Brooklyn, N. Y.
Medde, Carl E., General Delivery, Pittsfield, Mass.
Nash, W. F., 514 Blackstone Street, Woonsocket, R. I.
Schaller, W. A., Box 169, Pawtucket, R. I.
Stott, 11 Everett Avenue, Providence, R. I.
Tessier, Victor E., 25 Hammond Street, Worcester, Mass.
Webster, Fred H., 122 Grand Avenue, Providence, R. I.
Whitney, F. A., 1014 Summit Avenue, Greensboro, N. C.
Zell, Powell C., 557 West 174th Street, New York City.

LAST CALL!

Sixth Annual Meeting

American Association of Textile Chemists and Colorists

Friday and Saturday, December 3rd and 4th

Charlotte, N. C.

The First Annual Meeting South

Hotels

Rates are from $1.50 to $5.00 for one person and from $5.00 to $8.00 for two persons depending upon the hotel. There are four to choose from, Hotel Charlotte being the headquarters for the meeting.

Official Meetings of the Association

These will consist of an open forum on Friday evening and all-day sessions on Saturday. The full program has been mailed to you.

Side Trips

The committee of arrangements in the South has tentative plans for a number of plant visits or other interesting occupations for one or two days prior to the meeting. These plans are dependent entirely upon what **you** want so that any who would like to make some of these side trips should indicate it at the earliest moment.

Returning

The railroad company will have the same sleepers available for our return.

Please do not postpone your decisions but indicate to the committee now your intention of being one of the party.

COMMITTEE ON PARTICIPATION FROM THE NORTH

Elvin H. Killheffer (Chairman), Newport Chemical Works, Passaic, N. J.
John F. Bannan.....M. T. Stevens & Sons Co., North Andover, Mass.
Ralph F. Culver.....Ciba Co., Peck Street, Providence, R. I.
Hugh Christison.....Arlington Mills, Lawrence, Mass.
Herbert Grandage.....Clark Thread Co., Newark, N. J.
Daniel P. Knowland.....Geigy Co., 89 Barclay St., New York City
Robert E. Rose.....E. I. du Pont de Nemours & Co., Wilmington, Del.

OCTOBER DYESTUFF IMPORTS

(*Continued from page 786*)

Index No.	Schultz No.	Name of Dye and Mfr.	Quantity (pounds)
833	—	Wool Fast Blue BL—(IG)	
		Wool Fast Blue GL—(IG)	2,331
846	688	Rosolane Paste—(StD)	50
865	700	Silver Gray P—(IG)	50
873	681	Direct Gray R Paste—(G)	948
875	923	Fur Black DB—(IG)	
		Fur Gray G—(IG)	150
878	622	Brilliant Delphine Blue B—(S)	2,001
879	—	Chromazurine G—(DH)	220
884	627	Anthracyanine S—(DH)	
		Chromacetine Blue S Extra—(DH)	1,101
892	635	Modern Violet—(DH)	882
894	637	Gallamine Blue Extra Paste—(G)	2,491
905	645	Gallazine No. 90—(DH)	441
913	653	Danubia Blue BX—(IG)	1,250
914	654	Danubia Blue BBX—(IG)	50
924	660	Methylene Green G Extra Conc.—(S)	489
926	661	Thionine Blue GO—(IG)	1,000
927	663	New Methylene Blue N—(IG)	1,250
969	748	Hydron Blue R Powder (s. s.)—(IG)	1,000
1027	778	Alizarine VI Extra Pure—(B)	
		Alizarine Red VI Extra Pure—(IG)	11,265
1033	779	Alizarine Orange A Paste—(IG)	
		Alizarine Orange AO Paste—(BD)	
		Alizarine Orange SW Powder (s. s.)—(IG)	1,652
1034	780	Alizarine Red S—(IG)	
		Alizarine Red S—(DB)	
		Alizarine Red S—(Q)	1,904
1035	782	Anthracene Brown R Powder—(IG)	300
1051	799	Alizarine Cyanine GG Powder—(By)	500
1053	—	Alizarine Blue WS Powder—(By)	
		Alizarine Sapphire Blue SE—(I)	550
1054	858	Alizarine Light Blue B—(S)	
		Alizarine Light Blue B Conc.—(S)	6,005
1063	790	Acid Alizarine Blue BBN Conc.—(M)	500
1064	—	Alizarine Cyclamine R Paste—(IG)	794
1067	804	Alizarine Blue S Powder—(IG)	1,096
1070	807	Alizarine Black S Paste—(IG)	1,405
1073	852	Alizarine Blue JR Powder—(By)	
		Alizarine Direct Violet ER Powder—(IG)	
		Alizarine Irisol R Powder—(IG)	3,467
1075	856	Alizarine Blue AS—(By)	96
1076	859	Alizarine Light Blue R Conc.—(S)	1,000
1080	853	Anthraquinone Violet Powder—(IG)	1,500
1081	864	Anthraquinone Green GXNO—(B)	270
1082	863	Anthraquinone Blue Green BXO—(IG)	200
1084	854	Alizarine Viridine FF Powder—(IG)	50
1085	862	Chrome Blue Black B—(I)	220
1088	855	Alizarine Sky Blue B Powder—(IG)	
		Alizarine Sky Blue B Powder—(By)	2,760
1089	861	Anthraquinone Blue SR Extra Powder—(IG)	250
1091	—	Alizarine Rubine 3G GWR—(By)	
		Alizarine Rubinol 5G—(IG)	2,373
1092	—	Alizarine Geranol B Powder—(By)	1,455
1093	850	Vat Blue WB Powder—(B)	50
1095	759	Anthra Yellow GC Paste—(IG)	
		Anthra Yellow GC Powder (s. s.)—(B)	
		Vat Yellow GC Powder (s. s.)—(B)	4,192
1096	760	Vat Gldn. Orange G Dbl. Pst.—(s. s.)—(IG)	
		Vat Golden Orange G Pdr.—(s. s.)—(B)	
		Cibanone Golden Orange G Pdr. (s. s.)—(I)	14,856
1097	761	Vat Orange RRT Paste Fine—(IG)	2,398
1098	762	Anthra Scarlet G Paste Fine—(IG)	400
1099	763	Vat Dark Blue BOA Paste—(B)	
		Vat Dark Blue BOA Paste Fine—(IG)	4,583
1102	765	Vat Black B Paste—(B)	
		Vat Black BB Double Paste (s. s.)—(IG)	
		Vat Black BB Powder (s. s.)—(IG)	2,985
1113	842	Vat Blue GCD Double Paste (s. s.)—(IG)	
		Indanthrene Blue GCDN Pdr. (s. s.)—(B)	10,320
1118	849	Vat Yellow G Powder (s. s.)—(B)	824
1120	867	Anthra Brown B Paste—(IG)	842
1135	820	Vat Brilliant Violet RK Paste—(IG)	951
1144	870	Vat Corinth BB Powder (s. s.)—(GrE)	880
1146	828	Vat Bordeaux B Powder (s. s.)—(B)	1,352
1149	873	Vat Brown GR Powder (s. s.)—(IG)	500
1152	—	Vat Brown B Paste—(GrE)	
		Vat Brown G Paste—(IG)	2,294
1155	825	Algol Red B Paste—(IG)	400
1162	831	Vat Red RK Paste Fine—(B)	
		Vat Brown RK Powder (s. s.)—(IG)	
		Vat Brown RKP Powder—(IG)	1,948
1163	832	Vat Violet BN Paste—(B)	
		Vat Violet BN Powder (s. s.)—(B)	1,512
1184	881	Brilliant Indigo 4B Paste—(IG)	
		Brilliant Indigo 4B Powder (s. s.)—(IG)	14,460
1186	883	Indigo MLB/6B Powder (s. s.)—(IG)	3,000
1190	885	Brilliant Indigo B Paste—(IG)	2,558
1211	910	Helindone Pink BN Paste—(IG)	1,000
1212	918	Ciba Red 3B Paste—(I)	
		Ciba Red 3B Powder (s. s.)—(I)	
		Thioindigo Red 3B Powder (s. s.)—(K)	
		Vat Red Violet RH Powder (s. s.)—(IG)	7,874
1217	913	Helindone Orange R Paste—(IG)	2,000
1227	904	Helindone Brown G Paste—(IG)	500
1228	907	Anthra Scarlet 2G Paste—(B)	6,996
1228	907	Helindone Fast Scarlet C Paste—(IG)	2,500
1229	908	Ciba Red R Paste—(I)	14,328
1230	911	Ciba Orange G Paste—(I)	330

UNIDENTIFIED DYES

Acid Dyes

Name of Dye and Manufacturer	Quantity (pounds)
Acid Magenta LLS—(BD)	25
Acid Milling Yellow G Conc.—(S)	500
Acid Navy Blue MB—(Q)	10
Acid Rhodamine BG—(IG)	1,000
Alizarine Direct Red 3G—(Q)	110
Alizarine Supra Blue A—(IG)	650
Amido Fast Yellow SR—(M)	100
Azo Fast Blue BR Conc.—(IG)	100
Azo Wool Blue SE—(Q)	120
Brilliant Acid Blue EG Conc.—(IG)	150
Brilliant Acid Blue FF Conc.—(By)	611
Brilliant Milling Blue B—(IG)	
Brilliant Milling Blue B—(C)	4,474
Brilliant Milling Blue FG—(IG)	100
Brilliant Scarlet N—(IG)	100
Brilliant Silk Blue B—(I)	110
Brilliant Wool Blue FFR Extxra—(By)	367
Erio Carmine 2BC—(G)	551
Guinea Fast Red BL—(IG)	2,000
Indian Yellow GAM—(IG)	100
Indocyanine B—(IG)	5,000
Indoine Blue BB—(IG)	25
Ink Blue BITBN—(IG)	2,000
Kiton Fast Red 4BL—(I)	220
Metanil Red 3B Extra—(IG)	500
Milling Brown R—(IG)	100
Milling Red 6BA—(IG)	100
Milling Yellow 3G—(IG)	200
Milling Yellow O—(IG)	600
Naphthol Black BGN Conc.—(IG)	35

Name of Dye and Manufacturer	Quantity (pounds)
Neolan Blue BR—(I)	
Neolan Blue GG—(I)	
Neolan Blue GR—(I)	1,322
Neolan Orange R—(I)	1,102
Neolan Pink G—(I)	1,433
Neotolyl Black TL Extra—(IG)	300
Pilatus Fast Blue GG—(IG)	100
Pilatus Fast Gray B—(IG)	400
Polar Gray Greenish—(G)	55
Resorcin Brown B—(Q)	10
Sulpho Rhodamine G—(M)	120
Sulphon Orange G—(IG)	500
Sulphon Yellow R—(IG)	200
Supramine Blue B—(By)	100
Supramine Brown G, R—(IG)	200
Supramine Red B, 3B—(IG)	1,020
Supramine Yellow R—(IG)	250
Wool Black GRF—(IG)	2,500
Wool Blue 5B—(IG)	200
Wool Blue N Extra—(By)	110
Wool Fast Yellow G—(By)	47
Wool Fast Yellow 5G—(B)	552
Xylene Brilliant Blue FFRX Conc.—(S)	496

Vat Dyes

Algol Blue 3RP Powder—(By)	425
Alizarine Indigo 5R Paste—(IG)	200
Alizarine Indigo Violet B Paste—(By)	100
Anthra Scarlet B Powder (s. s.)—(IG)	600
Anthra Pink B Extra Paste—(IG)	2,500
Ciba Pink BG Paste—(I)	
Ciba Pink BG Powder (s. s.)—(I)	1,430
Ciba Red 3BL—(I)	88
Cibanone Green GC Paste—(I)	1,102
Cibanone Red 4B Powder—(I)	220
Eridan Brilliant Scarlet B Paste—(IG)	500
Grelanone Red 2B Paste—(IG)	250
Helindone Blue 3G Conc. Pdr. (s. s.)—(IG)	500
Hydron Green G Paste—(IG)	100
Hydron Olive GN Paste—(IG)	400
Hydron Pink FB Paste—(IG)	500
Hydron Pink FF Paste—(IG)	1,500
Hydron Scarlet 3B Powder (s. s.)—(C)	3,036
Hydron Yellow Brown G Paste—(IG)	500
Indigosol AZG—(DH)	110
Indigosol O4B—(DH)	110
Indigosol OR—(DH)	220
Paradone Gray B Paste—(LBH)	224
Paradone Olive R Powder—(LBH)	1
Thio Indigo Violet R Paste—(K)	110
Vat Blue RSN Powder—(IG)	100
Vat Blue RZ Double Paste (s. s.)—(IG)	1,992
Vat Brilliant Violet RRP Powder—(IG)	300
Vat (Hydron) Brown G Paste—(C)	220
Vat (Hydron) Brown R Paste—(C)	706
Vat Brown 2G Powder (s. s.)—(B)	
Helindone Brown 2G Powder (s. s.)—(M)	3,576
Vat Golden Orange 3G Paste—(B)	1,188
Vat Golden Orange RRTS Powder (s. s.)—(B)	165
Vat Green G Double Paste (s. s.)—(IG)	
Vat Green G Powder (s. s.)—(IG)	2,388
Vat Pink B Double Paste (s. s.)—(B)	
Vat Pink B Powder (s. s.)—(IG)	2,260
Vat Printing Red B Paste—(IG)	
Vat Printing Red G Paste—(IG)	1,300
Vat Printing Violet BF—(IG)	500
Vat Red 2G Paste—(By)	1,256
Vat Yellow GF Powder (s. s.)—(IG)	400
Vat Yellow RK Paste—(IG)	100
Vat Yellow 3RT Conc. Powder—(IG)	1,000

Mordant and Chrome Dyes

Acid Alizarine Gray G—(IG)	1,500
Acid Anthracene Brown PG Powder—(By)	550
Acid Anthracene Red 5BL—(IG)	500
Acid Chrome Red B—(IG)	150
Alizarine Astrol Violet B Powder—(IG)	125
Alizarine Brilliant Sky Blue R—(IG)	100
Alizarine Fast Gray 2BL—(IG)	500
Brilliant Chrome Blue S—(DH)	220
Chromanol Black RVI—(DH)	110
Chrome Printing Bordeaux B Powder—(I)	110
Chrome Printing Red B—(DH)	440
Chrome Printing Red Y—(DH)	441
Chromogene Indigo R—(IG)	10
Chromorhodine 6GN Extra—(DH)	220
Chromovesuvine RA—(DH)	110
Eriochromal Brown AFB—(G)	55
Eriochromal Brown G Powder—(G)	110
Eriochrome Blue Black G—(G)	5,511
Eriochrome Brilliant Violet B Supra—(G)	551
Eriochrome Red G—(G)	551
Eriochrome Violet 3B—(G)	551
Metachrome Blue Black 2BX—(IG)	1,000
Metachrome Brilliant Blue BLO—(IG)	100
Metachrome Olive 2G—(A)	1,000
Metachrome Red G—(A)	796
Modern Green N—(DH)	110
Radio Chrome Bluue B—(IG)	500

Direct Dyes

Benzo Fast Black L—(IG)	800
Benzo Fast Blue G—(IG)	472
Benzo Fast Bordeaux 6BL—(IG)	300
Benzo Fast Brown RL—(IG)	800
Benzo Fast Eosine BL—(By)	100
Benzo Fast Gray BL—(IG)	1,000
Benzo Fast Heliotrope 5RH—(IG)	200
Benzo Fast Orange 2RL—(By)	1,050
Benzo Rhoduline Red 3B—(IG)	500
Brilliant Azurine 5R—(IG)	100
Brilliant Benzo Fast Yellow GL—(IG)	500
Brilliant Benzo Green B—(IG)	500
Brilliant Congo Violet R—(IG)	500
Brilliant Copper Blue GW—(Q)	41
Brilliant Pure Blue B—(Q)	551
Brilliant Pure Yellow 6G Extra—(By)	372
Brilliant Sky Blue 8G Extra—(By)	220
Brilliant Sky Blue R—(By)	300
Chloramine Fast Violet R—(S)	10
Chloramine Violet FFB—(IG)	500
Chlorantine Fast Blue 2GL—(I)	3,196
Chlorantine Fast Blue 2GL—(I)	2,094
Chlorantine Fast Gray B—(I)	2,204
Chlorantine Fast Violet RL—(I)	1,984
Chlorantine Fast Violet 2RL—(I)	1,102
Chlorantine Fast Violet 5BL—(I)	5,507
Chlorantine Fast Yellow 4GL—(I)	1,102
Chlorazol Fast Orange AG—(BD)	1,000
Columbia Catechine G—(IG)	500
Columbia Catechine 3B—(IG)	100
Cotton Black AC—(IG)	100
Developing Blue B—(IG)	200
Diamine Brilliant Scarlet S—(C)	230

Name of Dye and Manufacturer	Quantity (pounds)
Diamine Bronze Brown PE—(IG)	100
Diamine Catechine G—(IG)	200
Diamine Catechine 3G—(IG)	500
Diamine Fast Bordeaux 6BS—(IG)	300
Diamine Fast Brown 3G—(IG)	100
Diamine Fast Orange EG—(IG)	500
Diamine Fast Orange ER—(C)	
Diamine Fast Orange ER—(IG)	1,555
Diamine Steel Blue L—(IG)	100
Diaminogene GG—(C)	1,653
Dianil Fast Violet BL—(IG)	500
Diazanil Pink B—(IG)	100
Diazo Brilliant Blue 2BL Extra—(IG)	600
Diazo Brilliant Green 3G—(IG)	
Developed Brilliant Green 3G—(By)	2,000
Diazo Brilliant Scarlet 6B Extra—(By)	499
Diazo Brown 2GW—(I)	220
Diazo Fast Blue 6GW—(I)	1,764
Diazo Fast Bordeaux BL—(IG)	500
Diazo Fast Violet BL—(By)	500
Daizo Fast Violet 3RL—(By)	500
Diazo Fast Violet 3RL—(By)	485
Diazo Indigo Blue 2RL—(IG)	300
Diazo Sky Blue 3G—(IG)	441
Diazo Sky Blue 3GL—(IG)	700
Diazol Light Red N8B—(CN)	4,409
Diphenyl Brown BBNC—(G)	1,102
Direct Brown G Conc.—(S)	336
Direct Fast Violet B—(By)	445
Direct Red 12B—(By)	267
Fast Cotton Rubine B—(IG)	100
Formal Fast Black G Conc.—(G)	110
Half-Wool Blue G—(IG)	1,300
Half-Wool Blue 3R—(IG)	1,000
Minaxo Blackk BBNX—(B)	200
Minaxo Fast BX—(B)	103
Minaxo Light Pink BBX—(IG)	200
New Bordeaux RX—(IG)	100
Paper Red A Extra—(IG)	1,000
Parasulphon Brown G—(S)	500
Pluto Black G Extra—(By)	970
Rosanthrene Violet 5R—(I)	110
Sky Blue N—(IG)	269
Trisulphon Brown MB—(S)	10
Zambesi Black D—(IG)	1,000
Zambesi Black V—(IG)	500

Dyes for Artificial Silk

Cellit Fast Brown G—(IG)	50
Cibacete Diazo Black B Paste—(I)	110
Cibacete Orange 3G Paste—(I)	110
Cibacete Orange 2R Paste—(I)	110
Cibacete Red GR Paste—(I)	110
Cibacete Scarlet G Paste—(I)	110
Cibacete Turquoise Blue Paste—(I)	110
Cibacete Violet 2R Paste—(I)	110
Cibacete Yellow 3G Paste—(I)	110
Cibacete Yellow R Paste—(I)	110
Dispersal Yellow 3G Paste—(BD)	212
Duranol Blue G Paste—(BD)	336
Duranol Red 2B Paste—(BD)	268
Pink B Extra Paste—(IG)	100
Ionamine H—(BD)	40
Setacyl Direct Blue G Powder—(G)	440
Setacyl Direct Blue R Powder—(G)	496
Setacyl Direct Orange 2R Powder—(G)	660
Setacyl Direct Violet R Powder—(G)	55
Yellow 3G Paste—(IG)	100
Yellow R Paste—(IG)	50

Rapid Fast Dyes

Rapid Fast Orange RG Paste—(IG)	500
Rapid Fast Pink BL Paste—(IG)	500
Rapid Fast Red GL Paste—(IG)	3,000

Basic Dyes

Acridine Flavine R—(DH)	551
Acridine Scarlet J—(DH)	55
Brilliant Acridine Orange R Conc.—(Roh)	220
Phosphine Orange—(G)	106
Rhodamine 6GDN Extra (s. s.)—(IG)	2,500
Rhoduline Sky Blue 3G—(IG)	368
Thio Violet 5R—(DH)	55
Xantho Phosphine G—(DH)	22

Sulphur Dyes

Indo Carbon CL—(IG)	3,000
Indo Carbon SN—(IG)	2,500
Katigene Indigo CLGG Extra—(By)	441
Pyrogene Brown G—(I)	551
Pyrogene Green GK—(I)	1,543
Thionol Black XXN Conc.—(BD)	550
Thionol Brown R—(BD)	2,240
Thionol Green B—(BD)	7,500
Thionol Yellow GR—(BD)	2,240

Color-Lake Dyes

Ceres Yellow III—(IG)	20
Hansa Yellow G Powder—(IG)	25
Hansa Yellow GSA—(IG)	2,000
Helio Fast Rubine LBK Powder—(By)	200
Helio Fast Violet AL—(By)	300
Helio Fast Yellow H10G Powder—(By)	200
Paper Fast Bordeaux B—(IG)	300
Stone Rubine G Powder—(IG)	100
Tero Black FB—(IG)	300
Tero Yellow FR—(IG)	500

Unclassified Dyes

Ink Blue H—(G)	55
Whitex Washing Blue—(Fze)	17,000
Coal-Tar Colors, Miscellaneous—(Q)	138

Color Lakes of Coal-Tar Origin

Brilliant Green GR Powder	1,000
Madder Lake VN Powder	600
Permanent Yellow H	10
Root Madder Lake Z Powder	25
Violet Lake in Drops	224
Violet S Powder	200

LIST OF APPRAISEMENTS OF COAL-TAR PRODUCTS WITHIN PARAGRAPHS 27 AND 28 OF THE TARIFF ACT OF 1922

The following supplemental list contains the month of entry, the name of the product within paragraphs 27 and 28, together with the designations as "C" (for competitive) and "NC" (for non-competitive), which indicates the appraisement basis for the assessment of the ad valorem duty in paragraphs 27 and 28 of the Tariff Act of 1922.

The ad valorem rate for competitive dyes is based on the American selling price as defined in Subdivision (f) of Section 402 of Title IV; the ad valorem rate for non-competitive dyes

is based on the United States value as defined in Subdivision (d) of Section 402 of Title IV of the Tariff Act of 1922.

This list contains the appraisements received since the publication of the September list for the port of New York, beginning with January, 1926:

JANUARY

Acid Rhodamine B Powder	NC
Anthra Brilliant Green 5G Paste	NC
Anthra Rubine B Powder	C
Anthra Yellow GC Paste	NC
Diamine Azo Fast Green G	NC
Direct Fast Blue 4GL Extra	C
Direct Fast Orange S	C
Direct Fast Red 8BL	C
Indocyanine B Powder	NC
Neutral Orange G Powder	NC
Vat Red FF Extra Paste	NC
Vat Violet 3B Powder	NC

FEBRUARY

Anthra Yellow GC Paste	NC
Diamine Azo Fast Green G	NC
Diphene Blue R	NC
Direct Fast Scarlet 5BL	C
Direct Fast Yellow GL	NC
Thio Indigo Scarlet 2G Paste	NC
Vat Green 2G Double Paste	NC
Vat Pink B Double Paste	NC
Vat Red FF Extra Paste	NC

MARCH

Anthra Scarlet 2G Paste	NC
Anthra Yellow GC Paste	NC
Brilliant Milling Blue B	NC
Diamine Azo Fast Green G	NC
Diaminogene GG	NC
Daizzogene Orange G	NC
Thio Indigo Orange R Paste	C
Vat Green 2G Double Paste	NC
Vat Violet RR Extra Paste	C

APRIL

Acid Blue RBF	NC
Chlorantine Fast Red 7BL	C
Chlorantine Red 8BN	NC
Ciba Red R Paste	NC
Ciba Yellow G Paste	NC
Diaminogene GG	NC
Diamine Azo Fast Green G	NC
Diamine Azo Fast Violet R	NC
Diamine Fast Violet FFBN	NC
Diazo Brilliant Scarlet 2BL Extra Conc	NC
Direct Fast Orange K	C
Patent Phosphine M	NC
Rosanthrene Rosa	NC
Thio Indigo Rose BN Extra Paste	NC
Thionine Blue G	NC
Vat Brown G Powder	NC

MAY

Anthra Scarlet 2G Paste	NC
Blue Lake Powder	NC
Diamine Orange B	NC
Vat Brown G Powder	NC
Vat Orange R Powder	C

JUNE

Alizarine Red S Powder	C
Patent Blue A	C
Wool Blue RR Extra	NC

JULY

Basic Pure Blue BO Powder	NC
Chloramine Blue HW	NC
Developed Brilliant Orange 5G Extra Powder	NC
Developed Brilliant Scarlet 2BL Extra	NC

AUGUST

Alizarine Light Blue B	C
Alizarine Light Blue SE Conc	C
Brilliant Chrome Blue S	NC
Brilliant Chrome Violet 3RA	NC
Chloramine Blue HW	NC
Chloramine Red 3B	C
Cloth Fast Yellow G	C
Chromazurine G Powder	NC
Chromorhodine 6GN Extra	NC
Methylene Green G Extra Conc	C
Rhodamine B Extra	C
Trisulfon Brown B Conc	C

Collecting the Literature of Textiles

By Chas. F. Goldthwait

Industrial Fellow, Mellon Institute of Industrial Research, University of Pittsburgh, Pa.

PERHAPS a few notes from the "practical" point of view will be of interest to supplement the editorial in the September 20 issue of The Reporter, where "Collecting the Literature of Dyeing" was discussed from a purely "theoretical" point of view.

Without claiming to be a "literature technologist," the writer has worked out a system through fifteen years of "trial and error" which would seem well adapted for use by anyone who desired to keep on file more than a routine knowledge of any branch of chemistry or textiles. In fact, it is now being applied to almost the whole field of textiles from production of raw materials to clothing, including, of course, all branches of textile chemistry.

The principles can be stated in three sentences, namely:

Keep everything in one file just as far as possible.

Use 8½ by 11 sheets and standard folders, reserving smaller cards and notebooks for special purposes where they are really necessary.

Keep the number of subdivisions as low as reasonably possible.

For readers who may be interested in establishing such an information file, the experience that led to these suggestions will be very briefly reviewed.

The cardinal principle is to keep all information in one place or at least to have cross references there. It was found, when keeping a card index, that notes were often desired that were too voluminous for cards, so these were preserved in notebooks or on sheets of paper. Then clippings began to accumulate and they were kept in still another place. The result was that information had to be sought from several sources, and then it became easy to overlook things.

Therefore, after trying them all, 3 by 5 cards, 4 by 6 cards, half typewriter-size sheets, different styles of note-

books, and standard 8½ by 11 typewriter paper, the last has been selected as the standard for all notes and references.

The best file is one of the types used for office correspondence, using similar folders, arranged alphabetically by subjects. For example, the first folder is A—Miscellaneous, then perhaps Acids, Adsorption, Alkalies, Analysis—Qualitative, and so on.

Advantages of Filing in One Place

Here are some of the reasons: Groups of related references can be carried on a single sheet and found even more conveniently than when on separate cards. Brief abstracts or voluminous notes can be taken and with no necessity for filing them separately. Correspondence, circulars, clippings, magazine pages, pamphlets, reprints, bulletins, and any smaller cards or sheets can be dropped in the same file. Material such as pamphlets may fit better if opened out flat, while the largest pages and almost anything that is oversize will fit by folding once, or at least without excessive folding.

The larger booklets may have to be kept separately; and if any subject accumulates to an unwieldly extent, it may have to be removed and a cross-reference put in its place. Incidentally, in including references to pamphlets and bulletins, it is often well to cover especially interesting or useful chapters or sections that have been found in books.

If notes are made on the 8½ by 11 paper, with some standard loose-leaf punching they can be kept in the file or transferred to a notebook for temporary use. In other words, notebooks should be interchangeable with the file, and the writer has gone so far as to keep all laboratory notebooks loose leaf and of this size even though the large books are at times unwieldy. To avoid the last difficulty, observations are often taken on standard sized sheets on a clip board.

Like the writer, perhaps, no one expects his file to grow to such large proportions; but if it does, it is a great convenience to have avoided copying the data from hundreds of small cards or trying to fit them into a larger file where they are only a nuisance.

In general, it seems best to keep the number of main subjects down; that is, the number of separate folders, but to allow a generous division into subtopics on separate sheets within the folders. Then, if a subject becomes outgrown, a reclassification is a simple matter.

As the writer's file became voluminous, one departure was made from the principle of keeping it all in one place. A so-called "Every Day File" indexed alphabetically was obtained for the desk. By keeping one or two sheets in it for each subject that has a folder in the main file, references and brief notes can be jotted down as they are found and at a considerable saving of time. As sheets become filled they are transferred and new ones started.

Each will have to decide for himself what material to keep. Besides the subjects of general interest it seems desirable to keep clippings and references covering good fundamental and authentic data on all live textile subjects. The writer was unexpectedly called upon to establish raw silk testing and had had no experience whatever in the subject. However, his file held a group of articles that had been saved merely because they seemed like reliable information on silk, and they proved to be practically all that was necessary. Similarly, information may well be kept on rayon, on its dyeing and chemical and physical properties; for if we have not already done so, most of us are going to encounter it in some way.

One can begin his filing system by using standard sheets in a notebook, but if clippings and other printed matter are saved it will be astounding how fast envelopes or folders will be needed, and then a filing case.

The writer has outlined the system as it has best served his own needs. Others may have different ideas, but on final analysis their requirements are likely to differ more in quantity than in the nature of the treatment. In the end the simplest way is the best way and the scheme outlined reduces complications to about the minimum. A well-kept file may be useful, while material kept in a heap so that it cannot be found when wanted, may as well be in the waste basket.

NATIONAL SILK DYEING COMPANY'S WASHING "DON'TS"

"Do not rub soap on hose" warns a folder recently distributed by the National Silk Dyeing Company of Paterson, N. J. The title of this folder is "Five Don'ts Essential When Washing Hosiery," and its purpose is to instruct the hosiery consumer in the proper methods of laundering in order that she may obtain maximum wearing qualities from her purchase. The text of the folder reads as follows:

Silk hose should be washed after each wearing in order to avoid strenuous cleansing methods, and action of perspiration on the fiber.

Do Not Rub Soap on Hose.—Do not rub the soap on the hose direct but dissolve the soap first.

Do Not Use Hot Water.—Create a good lather in warm water with any good neutral soap, then add cold water until lukewarm, work suds through stockings by dipping up and down.

Do Not Allow Stockings to Remain in Suds.—Entire washing should not consume more than three or four minutes. Rinse in two lukewarm waters and squeeze out. Do not wring.

Do Not Expose to Strong Light While Damp.—Dry indoors. Do not expose to strong light, especially rays of light transmitted through glass.

Do Not Dry on Radiator.—Avoid drying on radiator as excessive heat is detrimental.

AMERICAN
DYESTUFF REPORTER

Devoted to the use and application of dyestuffs and the mechanical equipment incidental thereto.

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THE MORAL IN EUROPEAN MERGERS

IN Europe, industrial trusts are viewed from one angle; in the United States they are viewed from another. When four large British chemical companies merged last month to form the Imperial Chemical Industries, Ltd., no warning cry arose from the alarmists bidding the public beware of this giant monopoly which might work to control the country's dyestuff trade and hold the mills at its mercy. Even in the face of rumors of a possible alliance with the German dye cartel, British sentiment smiled favorably on the new trust. It is regarded generally as very wise and logical; an essential move, in fact, representing a decided advance in the policy of the industry. In substance, the comments on it show recognition of the fact that no better step could have been taken to strengthen Britain's dye and chemical industries.

England realizes, as much as we, how vitally important it is to establish its dye industry on a solid foundation. There, as here, there existed an excess of plant, duplication of effort, severe competition. The industry merely did the obvious thing in uniting plant facilities, assuring an internal supply of raw materials and finding an outlet for surplus manufacturing effort in new products. The British Dyestuffs Corporation, as one unit in the merger, will obtain many raw materials from the other members of the group and will be able to cut overhead materially. The arrangement is ideal.

Meanwhile, representatives of the German dye trust are greeted here—according to confirmed reports—by representatives of the Standard Oil and the General Electric companies. Presently, at quiet conferences, more agreements are born. Certain chemical process rights held by the I. G.—one of the greatest industrial fusions in the world—are to be exchanged for petroleum and chemical patents owned by two of the largest American corporations. Thus another foreign dye industry is further bulwarked against world competition by more scientific operation of its huge plants through consolidations, and by the manufacture of countless new products having no relation to dyes except that they are basically chemical products. This arrangement also could hardly be improved.

While these foreign industries are merging because heavy overproduction has made dyestuff manufacture extremely unprofitable when the industry is not unified, what are we in the United States doing? We go forward patiently; we push into new markets abroad, develop new colors, better processes, more efficient methods of manufacture, in our individual plants. But when sales are balanced against costs the result is not satisfactory. We grow steadily in technical knowledge; we grow old in experience; we perfect new marketing methods, meeting the demands of mills for faster colors, knowing well that the American textile industry is "sold" on American dyes—but still we do not grow perceptibly stronger.

With all its unrivaled business acumen, with its modern plants and highly skilled personnel, and its faith in its own products, our dye industry will not become impregnable while it lacks one thing foreign industries have—the ability to work together for the common good of all.

ON COLLECTING TECHNICAL LITERATURE

IN a recent editorial we "theorized" in a general way on the advantages of keeping a reference file of literature on chemistry, dyeing, bleaching and related subjects. It was pointed out that such a file of technical articles, begun modestly, would soon grow into a kind of home-made encyclopedia on textile chemistry and more than repay the collector for his time and efforts. In this issue appears an article on "Collecting the Literature of Textiles," in which the author, Charles F. Goldthwait, describes a practical system of filing the papers, abstracts, leaflets and clippings gathered from the numerous journals on textile chemistry.

Mr. Goldthwait stresses the importance of keeping one's collection of literature in a single file, so that data may be found quickly and easily. At the risk of lapsing again into the purely theoretical, we quote a brief excerpt from a current number of our scientific contemporary, Industrial and Engineering Chemistry, which touches on another, broader side of the subject:

> Chemical and technical literature is expanding so rapidly that it is hardly possible to keep up with it any longer; and yet in chemistry the union of science and technology is indispensable. Just as the card index system for information service has been introduced into large scale manufacturing for a long time, recommendations are now being made that a central card index of the literature be established, which

would represent in its highest perfection a collection of all the wealth of experience of pure and applied chemistry which has been put into print. This central card index would appropriately be associated with the Patent Office; but it would be still more appropriate if an international arrangement for the exchange of scientific and technical literature could be effected.

The idea in this seems to be to apply Mr. Goldthwait's suggestion in a larger way to the collection of a veritable library of chemical literature, international in scope, by establishing one big central card index system. A technical information service on such a vast scale would, unquestionably be very valuable. Although still in the theoretical stage, the project is not impractical.

CHEMICAL EXECUTIVES ARE TO MEET AT THE BUREAU OF FOREIGN AND DOMESTIC COMMERCE

A number of executives in the chemical industry are marking a circle on their calendar around the date December 6, for on that day a meeting will be held in Washington which may be of far-reaching consequences to their industry. This meeting will be nothing less than a gathering of the key men of the chemical trades, under the direction of the Chemical Division of the United States Bureau of Foreign and Domestic Commerce, for the purpose of effecting closer contact between the Bureau and the industry.

The story goes back more than a year, to the time when a Chemical Advisory Committee was formed to work with the Department of Commerce. This committee comprises nine noted men of the chemical industry: Chairman, A. Cressy Morrison, New York; Secretary, Harrison E. Howe, Washington; Alfred E. Burdick, Chicago; Henry Howard, Cleveland; Ernest T. Trigg, Philadelphia; L. H. Baekeland, New York; Charles H. Herty, New York; Gustavus Ober, Jr., Baltimore; S. W. Wilder, Boston.

When these men met in Washington a year ago last May they were, on the whole, amazed to learn how useful the Bureau of Foreign and Domestic Commerce might be to the chemical industry if that industry took full advantage of the facilities offered by the Bureau's work. They decided that an invitation should be extended to the executives within the industrry to come to Washington that they might see for themselves what this active Government bureau is doing for American industry in general and for the chemical industry in particular. This meeting of executives, as stated above, has now been definitely set for Monday, December 6.

The complete one-day program for the meeting has been designed to give those attending a comprehensive picture of the operations of the Bureau of Foreign and Domestic Commerce. Speakers from each division of the Bureau will outline in ten-minute talks the activities of their section, and an additional time may be given to questions from the floor. The Chemical Division quite appropriately will not only assume an equal share in this program, but will also act as the focal point of the meeting.

Among the principal speakers will be Dr. Julius Klein, Director of the Bureau, who has just returned from a survey of conditions in Europe. He will probably speak on the functions of the Bureau of Foreign and Domestic Commerce in the industrial and commercial activities of the country. T. W. Delahanty will discuss chemical opportunities abroad; Louis Domeratsky will address the meeting on international economic features. The work of the Statistical Research Division will be outlined by its representative, E. Dana Durand, while six or seven other Division men will talk about the relation of their work to the promotion of the chemical trades. The time covered by this program is expected to be from 10 a. m. to 4 p. m.

At an informal subscription dinner in the evening Secretary of Commerce Herbert Hoover will be the sole speaker, and it is, of course, fully expected that what Mr. Hoover has to say regarding the possibilities in the chemical export field will be very much to the point and important.

According to advice from C. C. Concannon, Chief of the Chemical Division, if any visitors desire to remain over a second day the Bureau will gladly fill out the program to meet their convenience.

While the Chemical Division, and in fact the Bureau of Foreign and Domestic Commerce as a whole, has as its principal function the promotion of *foreign* trade, it will be understood that the importers and domestic producers' problems are equally deserving of study. The Chemical Division, like the other divisions of the Bureau, devotes a large and important share of its work to intensive research growing out of merchandising problems in this country, and its statistical service in this respect is continually being improved. Those executives, therefore, who receive an invitation to attend the Washington meeting next week, and who are not interested in foreign chemical trade promotion, will nevertheless learn many valuable things about those phases of the Bureau's work which concern their business.

The Advisory Committee, which has been quietly working in its own way to develop the advantages of closer co-operation between their industry and the Chemical Division, is looking forward to this meeting as an event of considerable importance to the industry. As a committee they feel that their efforts have been limited, because the industry as a whole has not had a clear idea of the work of the Bureau of Foreign and Domestic Commerce, and consequently has not been able to appreciate the value of working with it. Next Monday's meeting of executives from the various branches of the chemical industry should mark the beginning of closer rela-

tions between the purposes of the Bureau and those of the industry.

S. O. C. M. A. BOARD PRAISES DR. HERTY

The Board of Governors of the Synthetic Organic Chemical Manufacturers' Association has issued the following statement on the occasion of Dr. Charles H. Herty's resignation as president:

In accepting the resignation of Dr. Charles H. Herty, president of the Synthetic Organic Chemical Manufacturers' Association, the members of the Board of Governors fully appreciate the loss to the Association.

Dr. Herty has been our President since the organization of this Association. During that time, he has endeared himself to all our members by his wonderful personality, and his faithful and sincere efforts in behalf of our Association.

In an affiliation with the Chemical Foundation, Dr. Herty sees an opportunity for greater service in stimulating popular interest in chemistry.

Keenly as we regret this parting, we are happy to know that Dr. Herty, whom we love and respect, is entering upon a larger task. He has the very best wishes of every member of the Board of Governors for great success in his new work.

(Signed) August Merz, Chairman,
The Board of Governors,
The Synthetic Organic Chemical Manufacturers' Association.

Dr. Herty's future endeavors are briefly explained in the following announcement which he made two days before his resignation became effective:

During the five years' existence of the Synthetic Organic Chemical Manufacturers' Association the industry has become firmly established, not only in scientific and manufacturing skill, but also in public understanding, esteem and good-will. It needs now only to carry on.

The recent unanimous decision of the United States Supreme Court upholding completely the validity of the sale of the German patents to the Chemical Foundation opens innumerable avenues of useful public service for that unique organization.

Mr. Garvan, the President of the Foundation, feels that the lawyer and the chemist should joint hands in this great work. He has therefore invited me to devote my full time to the work of Adviser to the Chemical Foundation. I have gladly accepted, in the conviction that I could ask no better opportunity for contributing everything in my power to "the advancement of chemical and allied science and industry in the United States," as expressed in the charter of the Foundation.

(Signed) Chas. H. Herty.

An Executive Committee has been appointed by the Board of Governors to assume temporary control of the Association's work. This committee is made up of August Merz, E. H. Killheffer, W. F. Harrington and P. S. Rigney.

NEW SPRING COLOR CARD ISSUED

The 1927 Spring Season Color Card of America, created by the Textile Color Card Association, and just issued to its members, contains eighty-seven colors. The general temperament of the shades portrayed suggests animation and gaiety. While there is intensity of hue, it is balanced by a muting of tone which eliminates all crudity. While there are delicate tints in the collection, there is a marked departure from the pastel and crayon shades introduced by the association for the past two seasons, and which have been so dominant an influence in fashion.

A special feature of the card is eight groups each composed of three contrasting shades. This collection is called "Nosegays." All are flower shades with flower names, and each group simulates a bouquet from an old-fashioned garden. These stress the influence of flower tonalities in the coming mode, and the unusual combinations offer a fund of suggestions for merchandising.

"Our introduction of well-combined colors as a motif for the coming spring, supplements our introduction of composée colorings or the employment of two or three shades of one color which we featured on our 1926 Fall Season Card as Fairy Tales," said Margaret Hayden Rorke, managing director of the association, in commenting on the new card. "Our association was the first to anticipate the composée effects or "color steps," as they may be called. Their acceptance as a fashion theme has been most gratifying."

Turquoise and sapphire blues, yellow and oranges, pinks and grays occupy the leading position on the card. Among these are Rose Breath—a flesh pink; Blue Jewel—a new turquoise shade; Sunkiss—a glowing yellow; Golden Poppy—an Indian orange, and the extremely popular grays—Gull, Crane and Pelican, repeated. Beiges are stressed in variated tones, and in gradations of shade. Among the newest interpretations are three of distinctly roseate character called French Beige, Rose Beige and Marron Glacé. Another beige of distinct individuality embodies a suggestion of both mauve and rose; it is called Monkey Skin.

Another group of unusual feeling comprises Grecian Rose, Athenia and Tanagra. These are shades of pinkish terra cotta tones.

Blues occupy an important place, expressed in dull, silvery tones of the well-established Sistine, Gobelin and Flemish blues—the violet tinted hues of the Hydrangea and Mosaic blues, and the most intense shade called Liberty Blue; and the dark, rich indigo shade in the American flag called Independence—both of which bear their cognomens in honor of the 150th anniversary of American independence.

There are three separate groups of green—Pistache, Gooseberry Green and Palmetto border on the yellowish type, while the blue-gray tones are emphasized in the range called Dewkiss, Vert de Gris and Antique Green.

All of the ranges are carefully scaled in value and intensity, and represent three tones of one hue. As is the established custom of the association, the colors are placed so that they combine harmoniously both vertically and horizontally across the card, thus offering a well-balanced chart for the designer to work from.

The card concludes with the shoe and leather supplement. This contains seven shades, four of which have been repeated from former cards—Pastel Parchment—parchment with a rose tine; Stone—a light sand shade; Rose Blush—a beige with a rose cast; Shell Gray—a light, clear pearl gray; Stroller Tan and Hampstead Brown (for both men's and women's shoes), and Spanish Raisin—a dark wine shade with a mauve base.

The spring woolen colors, issued separately by the association, and indorsed by the American Association and Worsted Manufacturers, are now being distributed.

RAYON*

Identification of Rayon—Its Chemical and Dyeing Properties

By GEORGE H. JOHNSON

THE launderer at times may be interested in determining whether or not an article contains rayon, and even in distinguishing between the various types of rayon. Rayon may always be recognized by its extreme luster compared with that of silk, but when used with silk, as in hosiery, for example, rayon cannot always be recognized by such a casual examination. Acetate rayon, furthermore, possesses a luster more nearly approaching that of silk.

Rayon is easily distinguished from silk by the burning test. If a number of rayon fibers are tightly twisted to a wad and cautiously approached to the flame of a burning match, it will be found that viscose, cuprammonium and nitro rayons burn like cotton, with an odor somewhat similar to that of burning paper, and that they leave a very slight amount of ash. Silk, however, when tested in a similar way, gives off an odor similar to that of burning hair, and usually forms a black ball at the end of the twisted fibers, due to the presence of metallic weighting. Acetate rayon acts in an entirely different manner from the regenerated-cellulose type when burned. The acetate type burns more slowly and seems to melt or fuse into a dark-colored globular substance that is quite brittle. This hard globular substance should not be confused with silk weighting. Acetate rayon, like the regenerated celluloses, when burned gives off an odor similar to that of burning cotton or paper. As a confirmatory test for acetate rayon, treat 1 part of rayon with 100 parts of pure acetone. Under these conditions acetate rayon readily dissolves.

Another way of distinguishing between rayon and silk is to heat a number of fibers in a dry test-tube and to allow the volatile matter driven off to come in contact with a piece of moist neutral litmus paper placed at the mouth of the tube. If the paper turns red the fumes are acid, which is proof that the fibers are rayon. If the litmus paper becomes blue the fumes are alkaline and the fibers are silk.

The American Society for Testing Materials has offered the following methods for distinguishing between bleached and unbleached nitro, viscose and cuprammonium rayons:

1. Moisten a rayon thread with a solution consisting of 1 per cent diphenylamine in concentrated sulphuric acid. Nitron rayon immediately assumes a deep blue color and dissolves rapidly to a blue solution. Viscose and cuprammonium rayons are not colored blue and dissolve more slowly.

2. Immerse the thread for one minute in a boiling solution consisting of 1 per cent silver nitrate, 4 per cent sodium thiosulphate and 4 per cent sodium hydroxide. Cuprammonium rayon will remain unstained. Viscose rayon will be stained a brown or reddish-brown color. Nitro rayon will also be colored brown in such a test.

[Note: To prepare the test solution, dissolve the silver nitrate and sodium thiosulphate separately. Add the first to the second and the cloudiness will disappear. Add the previously dissolved sodium hydroxide, make up to the correct volume, bring to a boil, and filter.]

Chemical Properties of Rayon

Rayon, being vegetable in nature, the same as cotton or linen, may be attacked by oxalic and mineral acids if the latter are not rinsed from the fabric. Diluted solutions of these acids are harmless, however, if completely rinsed out afterward. Since sulphuric acid is a textile supply and not a laundry supply, this point needs no further consideration. Of the laundry sours, acetic acid, sodium acid fluoride and sodium silicofluoride are harmless to rayon even if traces are allowed to remain in the fabric. Rayon is not affected seriously by Javel water if the latter supply is used in in the proportions of 2 quarters of 1 per cent bleach to every 100 pounds of material. Javel water, however, should only be applied to materials containing bleached cotton. All-rayon pieces should never be bleached, because it is not necessary. Soap solutions are not in-

*Extracted from a special bulletin issued by the Laundry-owners' National Association, La Salle, Ind. The author is research fellow at the Mellon Institute of Industrial Research, University of Pittsburgh, Pittsburgh, Pa.

jurious to rayon and are suitable for laundering all-rayon materials. Cotton warp-rayon filling fabrics or cotton goods containing rayon decorative effects, however, must be laundered in conjunction with builder. Caustic soda should never be used, but soda ash, modified soda, phosphate, and silicates are suitable under 150 deg. Fahr. Starches and blues are non-injurious to rayon.

Nitro rayon sometimes develops a defect known as "acid rotting," which is said to be due to the presence of unstable sulphuric acid compounds of cellulose. Acid rotting weakens the nitro rayon and causes dyeing troubles.

Acetate rayon has given considerable trouble to dry-cleaners, due to the effect of many solvents upon the fibers. Ordinary solvents sometimes cause acetate rayon to swell, while such solvents as acetone and pyridine actually dissolve it. Even acetic acid if concentrated enough will attack acetate rayon.

The effect of ultra-violet light (occurs in sunlight) upon rayon is of importance because of the extensive use of the fiber in the manufacture of curtain materials and draperies. Recent work along this line has developed data that are contradictory. One authority reports that after a 24-hour exposure to a 1,600-c.p. mercury arc lamp cuprammonium rayon showed a loss of 32 per cent in tensile strength, while viscose and nitro rayons lost 48 and 56 per cent, respectively. Heermann, from his tests, has concluded that cuprammonium rayon is about as resistant to sunlight as linen, while viscose and nitro rayons are somewhat more resistant than cotton or jute.

Waentig, in tests similar to those of Heermann, obtained different results. Samples were exposed for twenty-four hours to a mercury-arc lamp and the following losses reported:

TABLE 6—BREAKING STRENGTHS

	Unexposed Grams	Exposed Grams	Loss of Strength in %
Egyptian cotton, unbleached.....	7.2	3.0	58.3
Egyptian cotton bleached.....	6.0	2.2	63.3
American cotton, unbleached.....	6.3	2.0	71.6
American cotton, bleached.....	6.3	1.6	74.6
Linen, bleached	16.5	7.3	55.0
Nitro rayon	13.4	12.5	6.7
Viscose rayon	9.7	8.5	12.4
Cuprammonium rayon	9.8	9.1	7.1
Acetate rayon	4.4	2.2	50.0

1. The table gives the average breaking strength in grams.

2. "Transactions of the Faraday Society," London, December, 1924.

According to the above table, nitro and cuprammonium rayons are more resistant to sunlight than viscose rayon, all three types showing great superiority over acetate rayon, linen and cotton. It is rather difficult to understand, however, why regenerated cellulose should be so much more resistant to ultra-violet light than cellulose in the form of cotton and linen.

In a series of investigations that have been made to determine the effect of bacteria on textile fibers, a number of tests were conducted to establish the deterioration of rayon through the action of cellulose-decomposing bacteria (Biochemical Journal, Vol. 19, pp. 1008-1094). Three sets of tests were run with nitro, cuprate, viscose and acetate rayons. One set of samples was placed in a nutrient solution which favored the development of cellulose-decomposing bacteria. A second set was buried on frames vertically in a light garden soil reaching to a depth of 30 cm. The third set of samples was submerged on fixed frames in sea-water. Cellulose-acetate rayon was found to be most resistant to bacteria. Ranking next were nitro rayon, viscose rayon and, last, cuprate rayon.

TABLE 7

DYEING PROPERTIES OF RAYON

Nitro or Chardonnet Rayon—

Dyestuff Used: Basic colors dye it directly. Direct cotton and sulphur colors are applied to nitro rayon by methods similar to those of cotton dyeing. Vat dyes may be used. Mordant colors are sometimes applied.

Cuprammonium and Viscose Rayons—

Dyestuff Used: Basic colors may be applied in conjunction with a tannin mordant. Direct, sulphur and vat colors are applied with comparative ease to these rayons. Lower temperatures are used and less salt is added as an exhausting agent than for cotton dyeing. The amount of caustic alkali used must be reduced to a minimum in the case of vat and sulphur colors and omitted if at all possible.

Acetate Rayons—

Dyestuff Used: Acetate rayons act entirely different from the above rayons, which consist of nothing more or less than regenerated cellulose. Basic colors, notoriously fugitive, appear to be the only regular dyestuffs that color acetate rayons. Only a few direct cotton and acid colors stain the latter type. Vat colors sometimes may be applied. Because acetate rayons possess different dyeing properties than the regenerated cellulose, a number of special dyestuffs have been developd that color the acetate type but not the others.

Colored rayons, in many cases, are much faster to laundering than colored silks. Basic colors are fugitive, but are somewhat faster when applied with a tannin mordant. Colored rayons generally will withstand lukewarm-water washing with soap solutions without much difficulty, especially when vat and sulphur colors have been used.

(To be continued)

Technical Notes from Foreign Sources

Recovery of Wool-Washing By-products

Many valuable by-products are recovered in the washing of wool. The main problems have been to devise the best methods for recovering the valuable products from these liquors. In the interesting article on this subject in a recent issue of Cuir Technique these are considered under four different headings. In the first place, there is the use of mineral acids. In this method the emulsified grease is separated by the addition of a mineral acid, the fatty matter separated by filtration and then hot-pressed. This process is said to result in a considerable loss of grease, while that recovered has a high content of fatty acids in the free state.

In the second general method metallic salts are employed to precipitate the grease, etc. Thus one process used an acid calcium chloride solution; in some cases milk of lime was employed. The purification of the complete grease proved to be a difficult matter and the method was abandoned.

Direct extraction of the wool with solvents was first tried in 1865, which date coincides with the first commercial production of a pure carbon disulphide. Carbon tetrachloride, petroleum ether and benzine are also used for this purpose.

The fourth general method is the use of centrifuges. The liquors are concentrated down to a proper point and then centrifuged, the fatty matters being obtained on one side and the potash solution on the other. One type of centrifugal process now in operation in Germany is as follows:

The raw wool is washed with water so as to give a solution of 12 to 14 deg. Be. This solution is evaporated down and calcined in special furnaces to give raw potash, which is used only by soap makers. The fuel required is 1 kg. of coal per kilogram of raw potash. The average composition of this potash is: Potassium carbonate, 72.94 per cent.; potassium sulphate, 6.27 per cent; potassium chloride, 8.08 per cent, and sodium carbonate, 5.66 per cent. The wool is next washed with soap liquor in the usual manner, the liquor being used for more than one batch, and a second rinse is given. The heavily grease-laden liquor is then centrifuged to recover the wool fat.

A process which has been patented in Italy allows for the preliminary sedimentation of the liquor to remove mineral matter. It is then centrifuged in such a manner that the remaining dirt settles on the cloth, the soap solution rises to the periphery, while the wool grease collects at the center of the machine. The soap solution is used again, while the wool grease is dehydrated. The mineral matter furnishes a nitrogenous and potassic manure when dry. A crude 70 per cent potassium carbonate is also finally recovered.

Dyeing Leather

Tanned leather is treated before, after or during dyeing with a solution or an emulsion of a hydrogenated naphthalene, such as tetrahydronaphthalene, with or without a halogen hydrocarbon, so as to effect solubilization of the grease and improve the dye penetration. The hydrogenated naphthalene may be emulsified, for example, by means of sodium, potassium or ammonium ricinoleate, hydrogenated phenol or cresol soaps, sulphonated or soluble vegetable, animal or mineral oils, or salts of aromatic sulphonic acids or aromatic acids.

In examples vegetable tanned leathers, such as basil, East India tanned sheepskins and hides, bark and sumac tanned calfskins, skivers, roans, etc., are wetted out, an emulsion of tetrahydronaphthalene added, and finally a dyestuff or the dyeing may be carried out in a separate bath. Chrome-tanned leather is washed, treated with an emulsion of tetrahydronaphthalene with sodium ricinoleate and trichloroethylene, and a dye added.

Vegetable, mineral tanned or oil dressed or aldehyde leather is wetted out and dyed, and then nourished or fat liquored by treatment with an emulsion of oil and tetrahydronaphthalene with or without trichloroethylene or trichloroethane. Vegetable or mineral tanned or oil dressed or aldehyde leather is wetted out, heated with an emulsion of tetrahydronaphthalene in hydrogenated phenol soap and ammonia or potash soap, and dyed in the same or a separate bath. (British Patent No. 255,555.)

Preventing Bronze Shades in Dyeing Cotton and Rayon

The production of undesirable bronzy shades charblack and blue sulphur dyestuffs, particularly when a standing bath is employed, may be prevented by treating the dyed fabric with a 0.1 per cent solution of sodium sulphide at a temperature of 30 deg. Cent. However, it is preferred to use a solution containing 3 per cent of acetic acid and 2 per cent of sodium dichromate at a temperature of 60 deg. Cent. Fabrics dyed with blue sulphur dyestuffs and subjected to oxidation with a 1 per cent solution of sodium perborate at a temperature of 60 deg. Cent. to develop the full shade are treated with sodium sulphide before the oxidation. Bronzy fabrics which have been dried are directly treated with a 0.2 per cent solution of sodium sulphide, previous wetting out being unnecessary.

Bronzy effects are also produced on cotton and

rayon fabrics which have been dyed with sulphur, basic and direct dyestuffs. For removing this effect on both cotton and rayon dyed with sulphur dyestuffs, the dyed fabric is treated with the usual hot "brightening" bath, which contains a Monopole soap or oil and lactic, formic or acetic acid. There are also added to this mixture from 1 to 2 kg. of gelatinized potato starch per 60 to 100 kg. of dyed fabric. The resulting non-bronzy fabric is somewhat harsh in handle, but this defect is removed by treating the material afterward with a solution of lactic, formic or acetic acid and diastase. The treatment is carried out at a temperature of 35 to 40 deg. Cent. The proportion of diastase is 100 grams per 10 kg. of dyed material. The fabric is then washed to free it from the starch, which has been hydrolyzed by the diastase.

Bronzy shades on rayon which has been dyed with basic dyestuffs are avoided by the addition of potato starch, in the proportion of 50 to 100 grams per 10 kg. of dyed material, to the dye liquor, and afterward correcting the resulting harshness and loss of brilliance of shade by treatment with a solution of diastase. The resulting shade has increased fastness to rubbing. (Meilland's Textilberichte, Vol. 6, page 665, and Vol. 7, pages 543-44.)

Acidizing Fabrics

In an apparatus for acidizing fabrics for carbonizing purposes, the fabric W, as shown in the accompanying illustration, in full width is led through a brake A^1 and broad stretcher B^1 to the soaking tank C^1, where it follows a zigzag course. The fluid in the tank is agitated with the aid of compressed air from pipe N. From the tank the fabric passes by a brake A^2 and stretcher B^2 to squeezing rollers D^1, and thence to a vessel C^2, the bottom of which is so shaped that the fabric lies and advances in loose plaits.

From the vessel C^2 the fabric passes through a brake A^3, stretcher B^3 and squeezing rollers D^2 and over a vacuum F of the slit type, and is finally laid in a tray H by a folder G. The saturated air from the extractor is led by a pipe J to a soda or like tank K. The vacuum extractor is rendered more effective by sealing part of the slip P, not covered by the fabric by means of an adjustable arm S.

The starting and stopping mechanism of the apparatus is linked by suitable levers to a valve in the suction pipe J of the extractor in such a manner that the suction through the slit P and the fabric will be started just before, or stopped just after, the travel of the fabric starts or stops. (British Patent No. 255,725.)

FIG. 1.

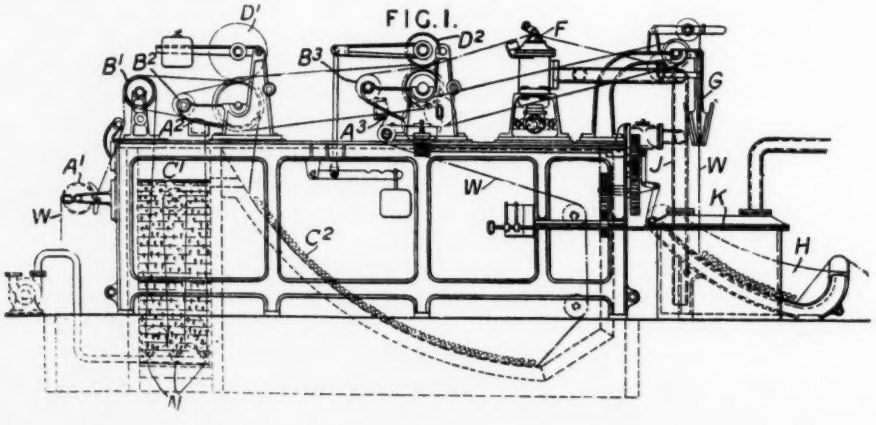
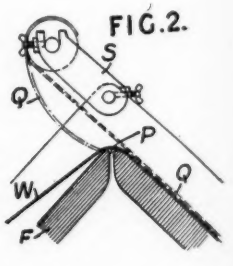


FIG. 2.



Simple Reaction for Differentiating Between Alpha and Beta Naphthol

Alpha-naphthol will give a characteristic deep violet coloration with carbohydrates in the presence of concentrated sulphuric acid. Beta-naphthol will also give a characteristic color reaction under the same conditions, which color is entirely different from the alpha-naphthol color, being green. This phenomenon affords a simple method of differentiating between the two substances.

Bleached cotton is the substance that is best suited for this purpose, as other carbohydrates, such as the starches, sugars, etc., although they give the same color reactions, nevertheless form lumps in the test tube and disturb the process. The method is as follows:

About one-tenth of 1 gram of the naphthol being investigated is added to a test tube, as well as a piece of bleached cotton and 10 c.c. of concentrated sulphuric acid. When alpha-naphthol is present a carmine-red color appears immediately in the solution; on the other hand, when beta-naphthol is present the solution turns a brownish color. These colors change as the test tube is allowed to stand and the color of the solution containing alpha-naphthol being a reddish violet, while that of the beta-naphthol passed through a reddish brown into a bluish green. After standing a few hours the colors remain unchanged and can easily be distinguished from each other.

This reaction can be carried out on the technical product, but it cannot be used with good results to determine the presence of one naphthol in admixture with the other. For example, when the proportion of beta-naphthol is greater than the alpha-naphthol, the

reddish violet solution of the alpha-naphthol assumes a dirty aspect, while the solution of beta-naphthol in the presence of alpha-naphthol changes from a bluish green to a blue. It is possible to detect the presence of one naphthol in admixture with another by comparing the colors obtained in the test with those secured by testing standard samples of pure alpha and beta naphthol. (Melliand's Textilberichte, 1926, page 863.)

RECENT LITERATURE

The Chemistry of Cellulose and Wood. By A. W. Schorger, Ph.D. International Chemical Series. 596 pages. 5 x 8. Illustrated. McGraw-Hill Book Company. $6.00.

Cellulose in its various forms is the most abundant organic compound in the plant world and has been used by man since time immemorial. For a century or more it has inspired cycles of chemical research, of varying intensity, the most pronounced being during the World War. At present investigation is being pursued by so many workers, and from so many different angles that it is to be hoped interest will not flag until the important structural relationships are established.

The vast number of organic compounds has been largely produced from simple chemicals by synthesis. The research was prosecuted on the basis of chance and probability and not hampered by knowledge of an existing sample which had to be duplicated or torn apart. Progress was from simple to complex, while with cellulose and lignin the reverse must be true.

This book aims to cover as completely as possible the scientific and empirical data available on the chemistry of wood. This has necessitated the inclusion of cotton and its modified forms. It gives the theoretical chemistry of cellulose and wood, and fundamental technical methods for their utilization in such industries as textile manufacture and the pulp and paper field.

The author is director of chemical research of the G. F. Burgess Laboratories, and was formerly research chemist of the Forest Products Laboratory, U. S. Forest Service.

Use of Glue in Coated Paper. By George K. Hamill, V. H. Gottschalk and George W. Bicking. Technologic Papers of the Bureau of Standards, No. 323. 40 pages. Illustrated.

This report is based on a series of tests made by the authors at the Bureau of Standards because of the interest among manufacturers of coated papers in alternative adhesives for use in their industry. Paper was coated on the coating equipment of the Bureau of Standards' experimental paper mill, using glues of different grades as adhesives and using casein for comparison, with the different types of minerals, clay, satin white and blanc fixe. The coated paper was calendered and subjected to printing tests at the Government Printing Office. The tests methods are concisely explained and the results tabulated.

The National Association of Cotton Manufacturers has issued a valuable index to its Transactions covering the period 1865 to 1925. Yearly and semi-annual volumes of the Association's Transactions have been published to the number of 119 and this index catalogs the contents of the entire number. It contains a complete index of all the papers presented at the association meetings, indexed both by author and subject, and where it has seemed desirable the title has been cross-indexed. Many of the discussions that took place at the meetings are likewise indexed.

A new edition of "What Price Progress?" by Hugh Farrell, completely revised and enlarged and in handsome format, has been published by G. P. Putnam's Sons. The original monograph of the same title, it will be remembered, was issued a year ago by the Chemical Foundation, Inc., and at that time caused a stir among industrialists and investors by its forceful and convincing discussion of industrial research. The new edition has been enriched in its material to the extent of including practically all of the matter that appeared serially in the New York Commercial under the title, "Does Research Pay?"

In a foreword the author explains that the original series was intended to show what happens to industry when it neglects research; while "Does Research Pay?" had the opposing purpose of showing how industry prospers when it fosters research. In the new volume these two broad themes are interwoven. Although the sub-title is given as "The Stake of the Investor in the Discoveries of Science," interest in the subject extends far beyond investors; the book touches in its appeal all those engaged in any branch of scientific work as well as a large section of the general public.

North Carolina State College and the Textile School were well represented at the Southern Textile Exposition. Eighteen textile students, most of them seniors, and two members of the Textile School faculty, Dean Nelson and Professor Hilton, attended the exposition and also the meeting of the Southern Textile Association. During this time, Dean Nelson and the students visited three establishments: Dunean Mills, Union Bleachery and the Franklin Process Company. In these mills former textile students are employed.

STANDARDS BUREAU REPORTS ON ITS DYE STUDIES

How dyes are being standardized and how standardizing methods of dye testing have been established is outlined in the latest statement on its work issued by the United States Bureau of Standards. Spectrophotography solved the problem of standardization, according to the report, from which the following is quoted:

In its work of establishing and maintaining standards the Bureau of Standards is confronted with many unusual and difficult problems. The variety of the work is likewise surprising to those not familiar with standards in the broadest sense.

For instance, the dye industry is in urgent need of exact standards for dyes and of standardizing methods of testing. The dye laboratory at the Bureau of Standards was established in 1922 and has been carrying out a program of fundamental investigations in co-operation with dye manufacturers and users.

Spectrophotometry Applied

The application of spectrophotrometry to dye problems is a dominant feature of the work, which includes the study of methods of evaluation, standard fastness tests, and other technical problems.

The spectrophotometric work consists of a quantitative comparison of the spectrum obtained by passing white light through a solution containing the dye and then through a spectroscope, with the spectrum obtained under identical conditions but without the dye. This gives an accurate record of the color of the dye solution. The data obtained can be used to estimate the amount of dye in the solution, its quality, etc.

Standardizing Method

Dyes of known purity have been prepared and standard spectrophotometric transmission measurements of their solutions in a number of solvents have been made, measurements which are not only useful in the identification and analysis of the commercial products but which constitute a fundamental standardization of the types.

The relationship between spectral transmission and chemical constitution of certain simple azo dyes has been studied quantitatively. The practical use of the spectrophotometric method for the commercial evaluation of dyes has been shown by comparisons with the titanous chloride titration and the usual dyeing test.

A dyeing method which is strictly quantitative and reproducible as well as more rapid than the usual commercial method has been developed. Work on fastness to washing and fastness to light has been done in co-operation with the American Association of Textile Chemists with the expectation that methods which are standards for all concerned with dyes and dyed materials will be established.

FAST VIOLET AND CYANINE AMONG THE LATEST NEWPORT COLORS

A new acid wool color, Newport Fast Acid RM Extra, and two new navy blues, Newport Fast Cyanine GB, 5R have been developed and placed on the market by Newport Chemical Works, Inc. Leaflets describing these products state that the Fast Acid Violet RM Extra is distinguished by its excellent level dyeing properties and fastness to rubbing, steaming, perspiration, salt water and sulphur bleach. Of very good fastness to washing, light and fulling, according to the description, its general qualities make it useful for dyeing bathing suit and sweater yarns, and ladies' dress goods.

Both Fast Cyanine GB and 5R are recommended for dyeing of navy blues on piece goods as well as on worsted yarns and are said to have excellent general fastness properties. Being fast to salt water, according to the announcement, they are important bathing suit colors. Dyed from a neutral bath they are of value for shading wool and silk in union fabrics. The GB type is said to have exceptional affinity for tin-weighted silk, dyeing dark shades of blue on this material. These shades are also said to be distinguished by their fastness.

NEW YELLOW FOR PAPER AND COTTON

The Dyestuffs Department of E. I. du Pont de Nemours & Co. has just placed on the market a direct yellow under the name of Du Pont Stilbene Yellow G Concentrated, which is suitable for use not only on paper but also on cotton and for lakes.

It is said to have good general fastness for a direct color.

The rate for "Position Wanted" advertisements in this column is 2 cents a word—with a minimum of 50 cents per insertion. For all other types of advertisements—i. e., help wanted, machinery or supplies for sale—the rate is $5.00 per column inch or less per insertion.

UNUSUAL OPPORTUNITY

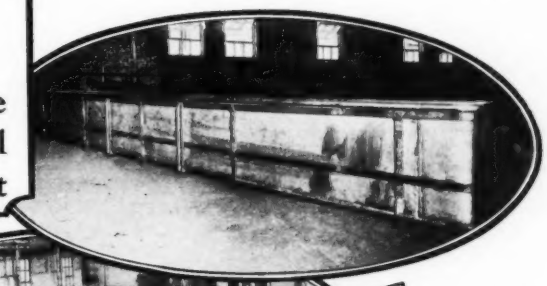
We have an attractive proposition for a result producer to promote the sale of our complete line of chemical textile specialties, such as Sulphonated Oils, Finishes, Softeners, etc., in Rhode Island and Connecticut. Only those fully qualified and who know how to produce need apply. All replies strictly confidential. Our organization knows of this advertisement. Reply, Box 361, American Dyestuff Reporter.

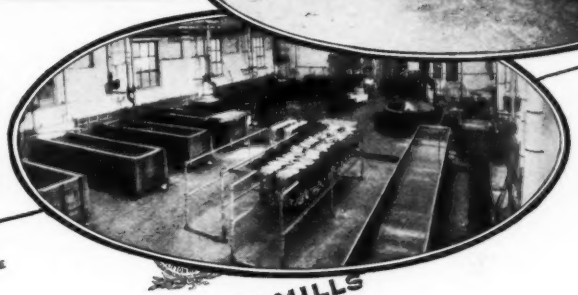
FRESH FLORIDA ORANGES

Fresh Sweet Florida Oranges, $3.00 per box of three hundred large size. Sound fruit and satisfaction guaranteed or money back. We pay express charges. A box of these makes an appreciated Christmas gift. Remit with order. Acme Farms, Gainesville, Florida.

Proved

Pink Shades and Black Are All the Same to Monel Metal Dyeing Equipment





Interior view of Clifton Yarn Mills, Inc. showing self-supporting Monel Metal tank and Monel Metal-lined tanks for skein dyeing. All the tank equipment illustrated mfgd. by LIBERTY COPPERSMITHING CO. OF PHILADELPHIA

Self-supporting Monel Metal dye tank of welded construction in use at Clifton Yarn Mills, Inc., Conshohocken, Pa. Dimensions 24 ft. x 2 ft.-2 in. x 2 ft. - 6 in.

EASTERN SALES OFFICE
GROSVENOR BUILDING
PROVIDENCE, R. I.

CLIFTON YARN MILLS
INCORPORATED
CLIFTON HEIGHTS PENNSYLVANIA

PLEASE MAIL REPLY TO
CONSHOHOCKEN PLANT
CONSHOHOCKEN, PENNA.

WORSTED SPINNERS
FANCY TWIST YARNS
SPUN & ORGANZINE SILKS
SPECIALISTS IN SKEIN SILK DYEING
RAW & THROWN SILK
RAYON
COMBINATION HOSIERY YARNS

MILLS: CLIFTON HEIGHTS, PENNA.
CONSHOHOCKEN, PENNA.
OLD FORGE, PENNA.

Conshohocken, Penna.
Sept. 1st., 1926

International Nickel Company,
67 Wall Street,
New York City, N.Y.

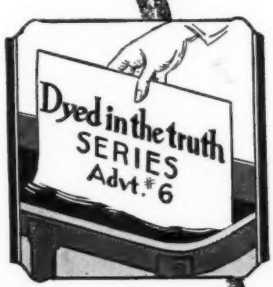
Gentlemen:

We take pleasure in advising you that the Liberty Coppersmithing Company of 1708 No. Howard Street, Philadelphia, who lined our wooden dye boxes with Monel Metal, have just recently completed for us one 24' Solid Monel Metal Tank, with a capacity of 800 gallon, with a number of Monel Metal utensils, all of which are extremely satisfactory. We now have 14 dye boxes in our plant.

You will be interested to know that we specialize in Indanthrene Colors on Rayon yarn. From our experience we feel that Monel Metal for the various dye house uses is unequaled and we base this statement on the fact that same has no effect on the various shades and it is so readily cleaned that pink shades can be dyed immediately following a black shade without the slightest difficulty.

To enumerate all of the advantages that Monel Metal offers us would require a very lengthy letter and we, therefore, suggest that should any of your prospective customers be doubtful of the practicability of using Monel Metal in any given process, we will gladly give them our experience in detail if they will communicate with us direct.

Yours very truly,
CLIFTON YARN MILLS, Inc.
H. H. Freund,
Chemist in Charge



Monel metal

THE INTERNATIONAL NICKEL COMPANY, 67 WALL STREET, NEW YORK CITY

COLOUR INDEX

in the English Language

Edited by

F. M. ROWE, D.Sc., F.I.C.

assisted by
C. LEA, M. Sc. Tech.
and
A Large Revision Committee of Experts

Size **12½"** x **9½"** **371** Folios (**742** Pages)

Bound in Full Leather $32.00 **Bound in Full Cloth** $28.00

COLOUR USERS will find the "Alphabetical List" which sets out the various Makers of each Colour of the greatest use and assistance to them.

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SECTION A—Synthetic Organic Dyestuffs (291 folios).
SECTION B—Natural Organic Dyestuffs (10 folios).
SECTION C—Natural and Artificial Inorganic Colouring Matters (Mineral Pigments) (16 folios).
SECTION D—General Indices, Commercial Names, Patent Numbers, Intermediate Products, etc. (54 folios).

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Mode of Application
Literature
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of

Over 1300 Dyes

given, also a special column for purchaser's notes.

PUBLISHED AND ISSUED BY

The Society of Dyers and Colourists

PEARL ASSURANCE BUILDINGS, BRADFORD, YORKS., ENGLAND

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Navy Blue Dyes
for
Cotton
Silk
Wool
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Direct, Acid, Chrome and Union Dyeing

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Philadelphia, Pa. Boston, Mass.

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Sent to you on request

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Manufacturing Chemists
1410 N. Front Street, Phila., Pa.

THE DYER,

Calico Printer, Bleacher and Finisher.

The only Organ of these trades in Great Britain

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The Dyer has already a large circulation in the United States and throughout the American Continent.

Add the name of your firm to the list.

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A straight color, fast to cross dyeing and very soluble.

Is brighter than any other Sulphur Green available.

An after treatment of Perborate of Soda still further enhances its brightness and causes complete oxidization, thereby assuring a color that will not change on ageing.

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Consult Us About Your Dyeing Problems

The services and advice of an expert chemist and a well equipped laboratory are at your disposal without cost, except when special research or experimentation is necessary, when the charges will be of a minimum nature.

American Dyestuff Reporter

90 William St. New York City

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1926
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THE NATIONAL, STATE AND LOCAL TUBERCULOSIS ASSOCIATIONS OF THE UNITED STATES

"FOG"

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"FOG" in your raw stock dyehouse means a continuous waste of fuel and a constant drain on your pocketbook.

It is no longer necessary to have this enemy of profits in your dyehouse. Franklin Process Raw Wool Dyeing Machines will absolutely eliminate it, as they dye under pressure *in closed kiers*. The fuel saving thus effected is very important.

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Improved dyeing results from the Franklin pressure method of forcing the liquor through the stock. The flow is in one direction only, while the stock remains stationary. Consequently felting is prevented and the stock is left in excellent condition for following operations.

The complete story of how Franklin Process Raw Stock Dyeing Machines eliminate "fog," lessen fuel consumption, and improve and speed up dyeing, is told in our booklet, "An Idea — and What Came of It." You will find it interesting and profitable reading. Send for a copy to-day. No obligation.

Several mills tell in this booklet, their experience with Franklin Process Raw Stock Dyeing Machines.

It's an exceptionally interesting story. A copy will be mailed to you, on request, free of all obligations.

The illustration above shows a battery of Franklin Process Raw Stock Dyeing Machines in operation in a well-known New England mill. Note the absence of dyehouse fog.

FRANKLIN PROCESS COMPANY

Manufacturers of Dyeing Machines, also Yarn Dyers and Manufacturers of Glazed Yarns

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